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for the Behavioral and Social Sciences

Research Report 1546

MANPRINT Evaluation of the High Mobility Multipurpose Wheeled Vehicle—Heavy Variant (HMMWV—HV)

Daniel A. Krohn and Douglass K. Spiegel
Essex Corp.

February 1990

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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This report presents the results of a MANPRINT (Manpower and Personnel Integration) evaluation of the High Mobility Multipurpose Wheeled Vehicle--Heavy Variant (HMMWV-HV). The evaluation was conducted by the Army Research Institute for the Behavioral and Social Sciences in conjunction with operational assessment of the HMMWV-HV by the U.S. Army Operational Test and Evaluation Agency (OTEA). Three configurations were examined: the maxi-ambulance, the mini-ambulance, and the S-250 communications shelter. Realistic missions were simulated in a field setting over a variety of terrains, and critical incidents and system operations problems were recorded as they occurred. These data were supplemented with interview and questionnaire data. Fifty-eight areas in which system improvements may be warranted are identified. Nine of the areas involve training; five involve maintenance; 20 involve human factors and operations; and 24 involve systems safety and health hazards.

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Human Factors in Training and Operational Effectiveness

FOREWORD

The primary mission of the Fort Hood Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to "conduct training and human performance research and MANPRINT (Manpower and Personnel Integration) assessments of units and systems in an operational environment in order to develop and expand the MANPRINT data base; support ODCSPER's responsibilities in test and evaluation as outlined in AR 71-2; and support user tests conducted by OTEA, TEXCOM, and the test boards."

The mission's technical objectives are "to identify and document unresolved MANPRINT issues and problems experienced by materiel systems undergoing user testing during the materiel acquisition process; to formulate and recommend courses of action in the MANPRINT domains of manpower, personnel, and training that will cost-effectively optimize performance of the system under test; to report other issues and problems identified in user testing to the appropriate agencies for the MANPRINT domains of human factors engineering, systems safety and health hazards."

This report presents the results of a MANPRINT evaluation of the High Mobility Multipurpose Wheeled Vehicle--Heavy Variant (HMMWV-HV) in late 1987. It falls within the purview of the ARI research project "Human Factors in Training and Operational Effectiveness," and was conducted in support of an operational assessment of the HMMWV-HV by the U.S. Army Operational Test and Evaluation Agency (OTEA). This support was in accordance with a Letter of Agreement between OTEA and ARI dated 15 June 1983.

During November 1987, the results of this research were briefed to the Commanding General, OTEA, and to representatives of the AMC Project Manager for Light Tactical Vehicles, the TRADOC Systems Manager for the HMMWV, and the Marine Corps. The content of this report was incorporated into the OTEA HMMWV-HV Test Report and into the OTEA Independent Evaluation Report. These reports are being used to support design and production decisions relating to modifications of existing high mobility wheeled vehicles and the design of potential new systems.

EDGAR M. JOHNSON
Technical Director

MANPRINT EVALUATION OF THE HIGH MOBILITY MULTIPURPOSE WHEELED VEHICLE--HEAVY VARIANT (HMMWV-HV)

EXECUTIVE SUMMARY

Requirement:

The purpose of this MANPRINT (Manpower and Personnel Integration) evaluation of the HMMWV-HV was to identify and document unresolved MANPRINT issues and problems experienced by three configurations of the HMMWV-HV: the maxi-ambulance, the mini-ambulance, and the S-250 communications shelter. The evaluation was conducted in conjunction with the September-October 1987 operational assessment of the HMMWV-HV by the U.S. Army Test and Evaluation Agency (OTEA).

Procedure:

The test was conducted in a field setting. The 34 participating soldiers filled positions of driver, aidman, and maintainer, in accordance with their MOS. Some of these personnel also simulated the role of patient at times. Realistic missions were simulated over a variety of terrains.

Data collectors were present on a continuous basis and recorded critical incidents and system operations problems as they occurred. Structured interviews and questionnaires were administered by human factors specialists. Key-point checklists covering test data requirements were completed, and comments by test subjects, data collectors, and observers were collected, collated, and analyzed.

Findings:

Fifty-eight areas in which system improvement can be made that will improve effectiveness are identified. Identified problems are of varying severity ranging from "minimal impact on mission fulfillment" to "significant impact on human performance leading to high probability of mission failure, damage to the vehicle, or injury to personnel. Problem solution considered essential for production model." Nine areas concern the need for training improvements; five concern maintainers; 20 concern human factors and operations; and 24 findings concern system safety and health hazards.

Utilization of Findings:

The results of this research were incorporated into the OTEA HMMWV-HV Operational Assessment Test Report and the OTEA Independent Evaluation Report.

The results are being used as input for design and production decisions relating to modifications of existing high mobility wheeled vehicles and the design of potential new systems.

MANPRINT EVALUATION OF THE HIGH MOBILITY MULTIPURPOSE WHEELED VEHICLE--HEAVY VARIANT (HMMWV-HV)

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MANPRINT EVALUATION:
HIGH MOBILITY MULTIPURPOSE WHEELED VEHICLE
HEAVY VARIANT (HMMWV-HV)

Introduction

This MANPRINT (Manpower and Personnel Integration) evaluation was conducted for three configurations of the HMMWV-HV: the maxi-ambulance, mini-ambulance, and S-250 communication shelter configurations. The test design plan emphasized the MANPRINT areas of human factors, safety, and health hazards, and it identified them as Test Issue 9. Other MANPRINT areas examined included training, and crew and maintainer literature. The purpose of the evaluation was to identify MANPRINT and related findings that could lead to system improvements and refinements. The evaluation was conducted in support of the U. S. Army Operational Test and Evaluation Agency (OTEA) by the Essex Corporation under contract to the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) Fort Hood Field Unit.

Several techniques were employed to collect MANPRINT data during the test. These included on-site recording of critical incidents by data collectors, key-point checklists covering test data requirements, structured interviews with test participants, and the recording of volunteered comments made by test participants. The collection of typical time and error performance data and other instrumented data (e.g., acoustical sound levels, vibration data) had been accomplished in conjunction with earlier tests and was determined by OTEA to be outside the scope of this test.

The report section titled "MANPRINT Findings" presents a summary of the test findings followed by detailed descriptions and illustrations of all major problem areas. The following section, "Structured Interview and Checklist Data", provides a detailed description of the data sources from which the report's findings were derived. Response frequencies for the items from the interviews and checklists are listed. The third section, titled "Comments Taxonomy," presents the subject findings organized by 22 primary MANPRINT categories.

Methodology

Data Collection Items

Within-test data collection materials included a total of ten structured interview, checklist, and questionnaire forms. The 1) Demographic Questionnaire (1 HFDQ) solicited information about the physical, educational, MOS, and experience characteristics of drivers and crewmen. The 2) Training Interview (HFTI) solicited opinions about the completeness and adequacy of new equipment training (NET). The 3) Aidman Interview (HFAI), 4) Driver Interview (HFDI), and 5) Sheltercrew Interview (HFSI) used a structured interview form which devoted several questions to each of the test issues relevant to MANPRINT. The 6) Aidman Checklist (HFAC), 7) Driver Checklist (HFDC), and 8) Sheltercrew Checklist (HFSC) were short, summary versions of the corresponding interviews

and also addressed remaining data requirements not covered by the interviews. The 9) Maintainers Interview (HFMI) covered scheduled maintenance and also activities necessitated by equipment faults and failures. The 10) Key Personnel Interview (HFKP) was general and was intended to provide guidance in identifying major areas of concern.

The structured interviews and checklists items had a Yes, No, N/A, and Comment response format. The Yes, No, and N/A format allowed respondents' opinions to be tallied. The N/A response was used when: a) respondents had no experience with the topic of the item, b) felt that the item did not apply to them, or c) chose not to respond. The comment format was open-ended and allowed the respondents to explain their responses in considerable detail. Form 1), HFDQ, did not provide space for comments.

The comments given are included with the response tallies after the listing of the individual questions in the section on "Structured Interview and Checklist Data." In addition to the above ten forms, comments and test participant observations were solicited throughout the test and recorded on an eleventh form) "Comments, Opinions, and Observations (HFCO)."

Human Factors Test Participant Debriefing

Approximately two weeks before the end of test, test directorate personnel evaluated the severity of identified MANPRINT problems and selected by consensus those problems considered to be sufficiently severe as to warrant their inclusion in a "Human Factors Test Participant Debriefing." This debriefing was set up to provide an opportunity to obtain comments focused upon the major problems that had been identified throughout testing. The comments were coded and added to the comment and opinion (HFCO) data base.

Data Collection Procedures

Procedures for the administration of the interviews and checklists were adapted to fit the availability of the respondents. Most interviews were administered to individuals and some to small groups. A few checklists were distributed for self-administration and collected later. HMMWV-HV crewmen were interviewed extensively during Phase II of the test. For Phase III of the test, a group debrief was used to discuss MANPRINT findings concerning the vehicle equipment and test operations. Mechanics were interviewed at length during both Phases II and III of the test. Unlike the crewmen who were able to identify most of the MANPRINT problems affecting them early in the test, mechanics did not experience MANPRINT problems until Phase III, at which time vehicle reliability was diminished by prolonged operation.

MANPRINT data were recorded onto floppy disks by data entry personnel and then periodically uploaded into data files accessible to Statistical Analysis System (SAS) programs resident in the OTEA1 system. SAS was used to tally the fixed responses on the questionnaires (PROC FREQ) and also to sort (PROC SORT) and print (PROC PRINT) the comments and opinions. Since random selection or random assignment of personnel for test participation was not possible, sophisticated statistical procedures were not appropriate for the analysis of the MANPRINT data.

Thirty-four test players provided demographic information. Their mean age was 21.9, the median was 20.6, and the standard deviation was 3.0 years. Twenty-eight test players were male; six were female. Since both male and female test players participated in the test, the height and the weight distributions were predictably bimodal: Height had modes at about 5.5 and 6.0 feet with a range from 5.2 to 6.3, and weight had modes at about 150 and 190 pounds with a range from 104 to 205. Median time in service was 1.5 years; the mean was 2.1 years, and the SD = 1.6 years. Median time working with the HMMWV was two months with the mean being 3.7 months, and the SD = 4.5 months. With a mode of one month this was clearly a very positively skewed distribution; the highest value was 20 months. As for training with the HMMWV, the mode was 20 hours, the median 30 hours, the mean 47.4 hours, and the SD 42.0 hours. Questions were asked to ascertain any serious visual, auditory, or motor problems and none were reported.

Scoring the Findings

The findings were scored at the conclusion of the test by the Deputy Test Directors for the Medical, Signal, and Marine Corps, and a MANPRINT representative. The raters used two scales to characterize system features and functions. One assessed the impact on performance; the second expressed the priority for correction.

Performance Impact Rating Scale. Five levels of Performance Impact are identified below:

A. The design deficiency has a significant impact on human performance, leading to a high probability of mission failure, damage to the vehicles, or injury to personnel. Problem solution considered essential for production model.
B. The design deficiency has a significant impact on human performance, leading to a high probability of degraded mission capacity. Problem solution should be included in the production model.
C. The correction of the design deficiency will significantly enhance the operability and/or maintainability of the system.
D. The design deficiency can be corrected by a hardware change or can be compensated for through training.
E. The design deficiency has minimal impact on mission. Correction will enhance human performance.

Correction Priorities. Five levels of priority applying to the need for corrective action are identified below:

1. Corrective action must be taken before a retest.
2. Corrective action must be incorporated before fielding.
3. Corrective action must be incorporated during fielding.
4. Corrective action would substantially improve performance and should be taken.
5. Corrective action would have minor impact on operation and should be taken if no significant cost is involved.

MANPRINT Findings

Scoring Results

Fifty-eight (58) MANPRINT findings were identified during the conduct of the MANPRINT Assessment. The MANPRINT findings were scored at the end-of-test by the Deputy Test Directors for the Medical, Signal, and Marine Corps, and a MANPRINT representative. The Performance Impact Rating Scale and the Correction Priorities scales shown in the methodology section were used to rate the findings. The scoring results for the 58 findings are given in Tables 1 through 4. There were 24 findings of safety and health hazards, 20 findings of human engineering problems, nine findings for training improvement, and five findings of maintainability problems.

Following the Summary Problem Descriptions, seventeen (17) detailed descriptions of major MANPRINT findings are presented. These detailed descriptions combine several of the 58 MANPRINT findings when the findings address the same item of equipment. The detailed descriptions indicate which of the vehicle systems were involved, and describe the findings, the cause, the implication, and the potential solutions. Line drawing figures taken from TM 9-2320-280-10 and the manufacturer's parts manual were used to illustrate the described equipment features.

Summary Problem Descriptions

Displays of the performance impact ratings and correction priorities are included in Tables 1 - 4 on the next eleven pages. The tables also name each of 58 problem areas and provide a brief description of each problem and its implications for system performance. Table 1 addresses 24 problems in the Safety and Health Hazards domains. Table 2 addresses 20 Human Factors problems. Table 3 addresses nine Training problems, and Table 4 covers five Maintenance problems.

Table 1

Safety and Health Hazard Problems

PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
(A) = MAXI-AMBULANCE, (B) = MINI-AMBULANCE, (C) = SHELTER CARRIER				
1. (AB) Rear doors inadvertently open.	The rear doors inadvertently open either as a result of the design of the latch or flexing of the fiberglass shelter.	Injury to crewmen. Loss of equipment.	1. A	1
2. (AB) Accumulating dust conditions and poor door seals.	Large quantities of dust enter the rear of the ambulances through the ventilation system and numerous vehicle gaskets and seals.	NBC and dust particle contamination of wounded.	2. A	1
3. (ABC) Heat from engine/transmission cowling.	Heat comes from the engine/transmission cowling between the driver and passenger and leads to high cab temperatures and burns crewman's legs.	Fatigue of crewmen.	3. A	1
4. (AB) Ambulatory bench seat has no restraining device for personnel.	There is no restraint system for personnel using the bench seat. Wounded may slump or fall from the seat. A hazardous situation exists for all personnel while vehicle is moving over rough terrain.	Injury to wounded.	4. A	1
5. (A) Sharp edges on upper litter racks.	Sharp edges on the litter rack inside of the ambulance compartment are a hazard to personnel.	Injury to crewmen or wounded.	5. A	2
6. (A) No ceiling handholds for personnel.	There are no handholds on ceiling for personnel to use while moving about the rear of the ambulance.	Injury to personnel.	6. A	2

Table 1 (Continued)

Safety and Health Hazard Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
7.	(AB) Sharp edges on the step (aidman's) seat.	The edges of the seat and around the latch and safety strap may cut personnel.	Injury to personnel.	7. A	2
8.	(B) Sharp edges on wall of stowage location.	The wall of the stowage location, at the head of the litter rack, has sharp edges. The sharp edges may be struck by the wounded or attending aidmen.	Injury to crewmen and wounded.	8. A	2
9.	(C) Tailgate tripping hazards.	There are two tripping hazards at the rear of the communication shelter: (a) the gap between the tailgate when lowered and the rear of the vehicle; and (b) the gap between the bed of the vehicle and the lower edge of the shelter.	Injury to crewmen.	9a. A 9b. D	2 4
10.	(A) Ambulatory bench seat has no padding.	The ambulatory bench seat in the maxi-ambulance has no padding on the seat or back to protect personnel from vehicle hard surfaces or sharp edges.	Discomfort and injury to wounded.	10. C	2
11.	(ABC) Sun glare blinds drivers.	Sun glare from the sun's position low on the horizon blinds drivers. No sun visors are provided.	Collisions with objects.	11. C	3
12.	(ABC) Cab vent for fresh air delivery blows hot air.	The vehicle cab vents only blow hot air into cabs.	Fatigue of crewmen.	12. C	4

Table 1 (Continued)

Safety and Health Hazard Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION		PERFORMANCE IMPACT	CORRECTION CATEGORY
13.	(AB) Litter ramp hooks detach from vehicle.	The litter ramp hooks frequently detach during loading on level ground.	Injury to wounded.	13.	D	3
14.	(AB) Litter ramp edges cut the hands of aidmen.	The sharp upright edges on the litter ramp that guide the litter cut aidmen's hands when the litters slide up or down.	Injury to crewmen.	14.	D	4
15.	(AB) The rear step (aidman's) seat latch is unsafe.	The latch for the rear step (aidman's) seat may be inadvertently unlatched. If released, personnel using the step aidman's seat could be ejected from the vehicle.	Injury to crew.	15.	D	4
16.	(AB) No safe access route to the ambulance roof.	There are no steps or handholds that crews can use in order to access the ambulance roof to tie down antenna, cover red cross.	Injury to crew from using an improper access to the roof.	16.	E	4
17.	(AB) Rear doors are difficult to secure in the open position.	The secure clip on the side of the ambulance is difficult to align the doors with when securing open doors. The latch peg on the door is difficult to grasp. The peg seat comes off the vehicle.	Crew injury - Wind or Helo blast may cause unsecured doors to strike crewmen.	17.	A	2
18.	(AB) Ambulance rear step blackout light striker.	The blackout light striker is flimsy and prone to bending, keeping the white lights off.	Injury to patient or aidman.	18.	A	2
19.	(AB) Litter ramp is difficult to use on uneven ground.	The litter ramp wobbles and comes unhooked from rear of vehicle when used on uneven ground.	Injury to wounded.	19.	A	4

Table 1 (Continued)

Safety and Health Hazard Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
20.	(AB) Litter secure straps are difficult to tighten.	The litter secure straps (tie downs) are difficult to apply to achieve the proper tension and positive locking.	Injury to wounded.	20. C	2
21.	(AB) Litter secure strap hooks slide on litter handle.	The litter secure straps loosen while the vehicle is moving, and hooks slide on the shaped litter handles.	Injury to wounded.	21. C	2
22.	(B) Handhold straps are difficult to use.	The handhold straps are difficult to slide hands in and out of. The straps do not prevent loss of one's balance. The straps pull out of the ceiling.	Injury to personnel.	22. C	2
23.	(ABC) Side stowage compartment door has no support.	The side stowage door opens upward, but does not have support when open.	Crew injury - Side door can slam on crewman's hands.	23. D	5
24.	(AB) Ambulance rear doors.	No indication is given to driver if rear doors are reopened prior to vehicle departure.	Injury to crewmen. Damage to equipment.	24. D	4

Table 2

Human Factors Problems

PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
(A) = MAXI-AMBULANCE, (B) = MINI-AMBULANCE, (C) = SHELTER CARRIER				
1. (ABC) Driver and passenger seats have too little padding.	Padding on the driver's and passengers' seats do not protect personnel from sustained vehicle vibration.	Crew fatigue.	1. A	1
2. (AB) Ambulance bulkhead door blackout switches.	The blackout switches for the bulkhead doors are improperly located and allow the white lights to stay on.	Defeat blackout light system.	2. A	2
3. (ABC) The rear view side mirrors distort views.	The mirrors vibrate, distorting the crewman's view to the rear.	Inadequate rear vision.	3. B	2
4. (ABC) The rear view side mirrors loosen.	The mirrors loosen as a result of vibration and collisions with objects.	Inadequate rear vision.	4. B	2
5. (ABC) The right side rear view mirror is difficult to view.	The driver's view of the right side rear view mirror is blocked by the right windshield pillar.	Inadequate rear vision.	5. B	2
6. (A) Litter rack rear suspension strap interferes with the rear step latch.	The rear strap of the litter rack interferes with the latching and unlatching of the rear step.	Increased time to load wounded.	6. C	2

Table 2 (Continued)

Human Factors Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
7.	(ABC) Windshield wiper control difficult to reach.	The windshield wiper control is placed high and to the right of the driver. The control is difficult to reach for many drivers.	Driving distraction.	7. C	4
8.	(ABC) Driver seat height and fore-aft adjustment.	The height of the driver's seat cannot be adjusted without affecting leg room.	Crew fatigue. Inadvertent activation of foot pedals. View from driver's seat.	8. C	4
9.	(AB) No stowage for additional equipment.	No stowage is provided for the following items: a. Additional water or fuel jerrycans b. Camouflage net c. NBC decontamination or cleaning brushes.	Additional equipment needed for combat and NBC conditions will not be available or will clutter work areas. Additional water is not available for heat stroke victims.	9. Additional jerrycan stowage: D Camouflage net: E NBC (cleaning) brushes: E	4 5 5
10.	(AB) Rubber latches on side stowage compartment break.	The rubber latches are broken off the side stowage compartment by collisions with vegetation or other objects.	Equipment damage or loss.	10. D	5
11.	(AB) Fragile device for securing ambulance bulkhead.	The forward bulkhead doors do not stay secured in the open position. The device that holds the shelter forward door open breaks or unlatches.	Distraction to driver and aidman.	11. D	4

Table 2 (Continued)

Human Factors Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION		PERFORMANCE IMPACT	CORRECTION CATEGORY
12.	(AB) The sliding seat does not have enough locking positions.	The aidman's sliding seat does not have enough locking positions in order to access patient to perform all medical monitoring and treatment functions.	Increased time to perform tasks.	12.	D	4
13.	(C) Rear canvas wall flaps cause high noise levels, drafts, and dust.	The rear canvas wall of the cab flaps, causing high noise levels interfering with discussions between driver and commander. The flap allows high levels of dust to enter the cab.	Increased time to perform task.	13.	D	4
14.	(ABC) Pioneer tool racks are not interchangeable.	The pioneer tool racks for latching the HMMWV-heavy variant have a different device than those used on other HMMWV versions.	Special manufacturing requirements for HMMWV-HV pioneer tool racks.	14.	D	5
15.	(AB) Intercom controls and labels upside down.	Mounting holes for the intercom systems as delivered were drilled to mount the intercom upside down.	Equipment use degraded.	15.	D	4
16.	(ABC) Driver visibility degraded.	Drivers are seated too low in the driver's seat for optimum visibility of the right front quarter of the vehicle. Drivers have difficulty making left turns due to their vision blocked by the left windshield pillar.	Inadequate vision.	16.	D	4
17.	(C) No tie downs on shelter roof.	Inadequate number of tie down points are provided for stowage of equipment on roof.	Additional equipment stowed in the shelter will interfere with setup time.	17.	E	5

Table 2 (Continued)

Human Factors Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION		PERFORMANCE IMPACT	CORRECTION CATEGORY
18.	(AB) Crews experience nausea.	Crewmen riding in the ambulance compartment experience feelings of nausea.	Increased time to perform tasks. Crew fatigue.	18.	E	5
19.	(AB) No means to lock the ambulance for security.	There is no way to lock the vehicles to prevent theft of medical supplies or BII equipment.	Equipment loss. Adds excess mission preparation time.	19.	E	5
20.	(C) Cab radio antenna is difficult to access and tie down.	The antenna is located at the center leading edge of the roof. In this position, it is difficult to access or tie down.	Increased time to perform task. Injury to crewmen.	20.	E	4

Table 3

Training Problems

PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
(A) = MAXI-AMBULANCE, (B) = MINI-AMBULANCE, (C) = SHELTER CARRIER				
1. (AB) Head of wounded strikes vehicle bed when litter ramp is used.	The head of the wounded litter patient strikes the vehicle bed as the litter slides forward on the ramp.	Injury to wounded.	1. D	4
2. (AB) Litter ramp cross braces trip aidmen.	The cross braces at the lower end of the litter ramp trip aidmen as they walk forward sliding the litters forward.	Injury to crewmen.	2. D	4
3. (AB) Rear step safety strap is difficult to use.	The rear step safety strap cannot be seen by crewmen positioning steps from outside of the vehicle. The safety strap cannot be seen in order to insert the hook into its ring.	Increased time to load or unload wounded. The strap is not used.	3. D	4
4. (A) The lower socket for the coilcord moveable light is difficult to reach.	The lower socket for the coilcord moveable light is partially blocked by the lower litter rack.	Equipment will not be used.	4. D	4

Table 3 (Continued)

Training Problems

	PROBLEM (AREA)	DESCRIPTION	IMPLICATION		PERFORMANCE IMPACT	CORRECTION CATEGORY
5.	(AB) Litter ramp stowage compartment.	The litter ramp securing strap in the stowage compartment is cumbersome to use and crewmen do not use it.	Equipment damage or loss.	5.	D	5
6.	(AB) Coilcord for moveable light entangles with IV tubes.	The coilcord for the aidman's moveable light may become entangled with IV tubes.	Injury to wounded. Increased time to perform tasks.	6.	D	5
7.	(A) Space between litter racks too small to perform CPR.	The pace between the upper litter rack and roof, and between the lower and upper litter racks, is too small to perform CPR.	Ability to provide care degraded.	7.	D	5
8.	(C) Shelter is time consuming to align and install.	The operators manual should be revised to remove front passenger's seat prior to shelter installation. The sequence to tighten the mounting kit bolts should be revised to tighten the angled bolt first, then tighten the two brace to bracket bolts.	Increased time to perform task.	8.	D	5
9.	(AB) Vehicle noise interferes with use of stethoscope.	The aidmen cannot hear the wounded's pulse rate or lungs using a stethoscope due to vehicle noise.	Ability to provide care and monitor patients degraded.	9.	D	5

Table 4

Maintenance Problems

PROBLEM (AREA)	DESCRIPTION	IMPLICATION	PERFORMANCE IMPACT	CORRECTION CATEGORY
(A) = MAXI-AMBULANCE, (B) = MINI-AMBULANCE, (C) = SHELTER CARRIER				
1. (ABC) Removal of gas tank sending unit.	There is no access to the gas tank sending unit for removal of the unit without lowering the gas tank.	Increased time to perform task.	1. D	4
2. (ABC) Access to exhaust manifold flange bolts.	The exhaust manifold flange bolts on the right side of the engine are difficult to reach.	Increased time to perform task.	2. D	4
3. (ABC) Access to vent lines.	The vent lines for the transfer case, differential, and transmission are difficult to install due to confined spaces and locations.	Increased time to perform task.	3. D	4
4. (ABC) Access to bolt holding the throttle cable.	Greater access is needed in order to reach the bolt attaching the throttle cable bracket to the intake manifold.	Increased time to perform task.	4. D	4
5. (ABC) Procedures for removal of starter.	Insufficient detail in maintenance manual for removal of starter. The starter must be rotated out or the transmission inspection plate must be removed.	Improper procedures. Equipment damage.	5. D	4

Detailed Problem Descriptions

In contrast to the tabular identification of problems discovered with the HMMWV configurations during the operational assessment testing, this section will provide problem descriptions in greater detail, including line drawings of those parts of the vehicle exhibiting or containing the problem(s). The detailed descriptions are presented under 17 subheadings, which are problem descriptive phrases. Within each description, the version of the vehicle applicable is indicated, and the MANPRINT domain is identified. Then comes information under the headings of 1) Description of the Problem; 2) Probable Cause; 3) Implications; 4) Potential Solutions; 5) Data Source. A figure is then presented to provide graphic illustration of the problem.

Ambulance Rear Door Latching Mechanism — Detailed Description 1 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Safety & Health Hazards/Equipment Design

Description of the problem. The rear doors for both the mini- and maxi-ambulances have inadvertently opened during normal operation. The hardware and latching mechanisms involved are shown in Figure 1.

Probable cause. Latch rod seats have sustained a great amount of wear, reducing their ability to properly seat the latch rod. The latching mechanism will allow the latch rod to ride on the edge of the plastic latch seat, leading the operator to believe the door is properly closed. Even when the latch rod is not seated, the bow in the latch rod makes the door handles appear as they do when the doors are locked.

During cross-country operations, a rocking motion set up by road conditions results in locked doors shimmying back and forth relative to each other. This swaying works the latch rods until the door handle twists and the door opens.

To close the doors, operators must apply pressure against the rear door while simultaneously rotating the door handle 90 degrees. This procedure is difficult to perform single handed and even when using both hands. If firm pressure is not applied while rotating the latch handle, the doors may only appear to be locked.

Implications. Unsecured doors pose a safety hazard to personnel inside the enclosure, and may require unscheduled stopping of the ambulance.

Potential solution. To achieve positive locking of the rear doors:

Lengthen latch rod to increase the amount of engagement in the latch seat, and taper the end of the latch rod to facilitate its insertion.

Use a more durable material for the latch rod seat. Also, internally ramp the latch seat to improve latch rod alignment into the seat.

Insert a caution in operators manual to insure that door latch is fully engaged.

Incorporate a "door ajar" indicator on driver's console and in the rear of the ambulance. Circuit may incorporate existing blackout switches. This indicator may also instrument proper closure of the steps.

Data source. Interviews with crewmen involved in door-opening incidents. RAM data.

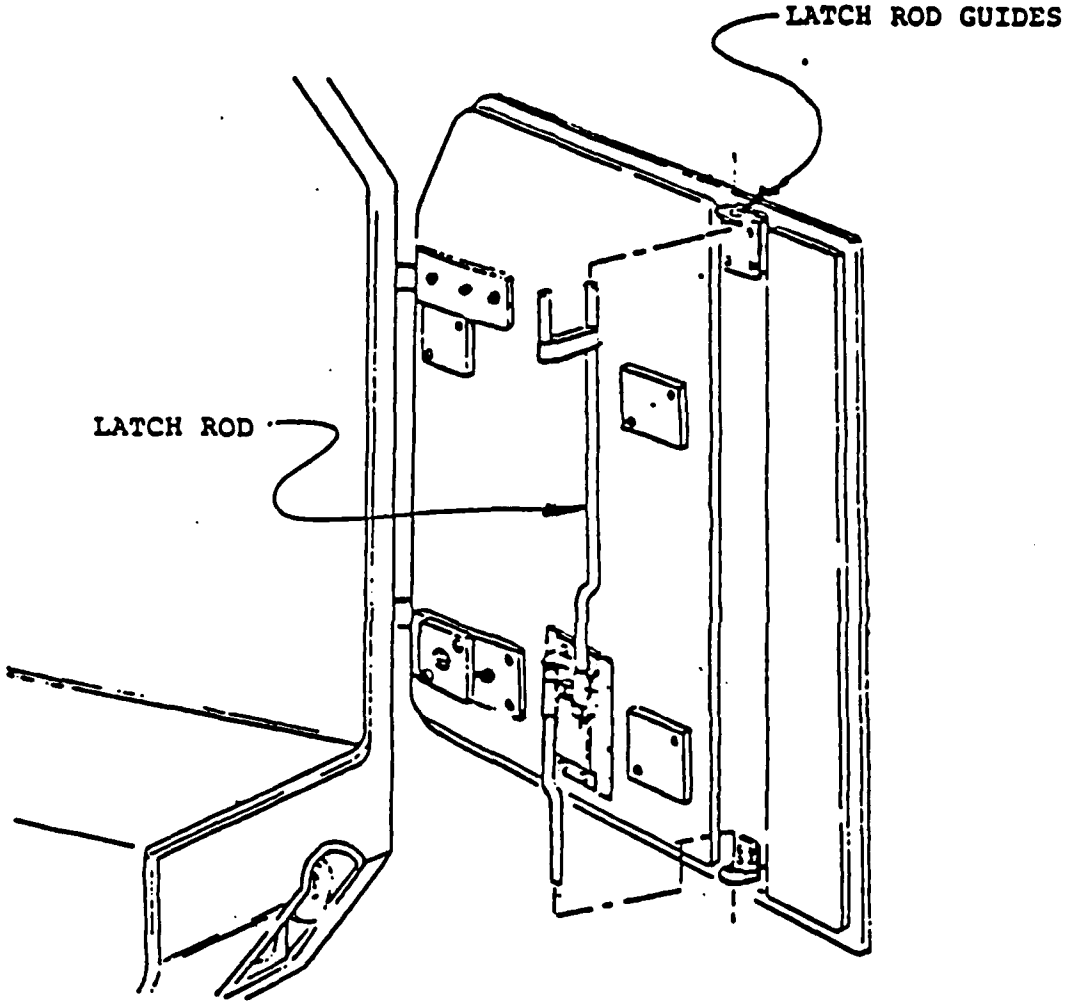

Figure 1. Rear door latching mechanism

Ambulance Rear Entry Steps — Detailed Description 2 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Safety & Health Hazards/Equipment Design

Description of the problem. The rear entry steps for the mini- and maxi-ambulances have the following problems:

The stair release latch is stiff, prone to sticking, and interferes with the litter support strap in the maxi-ambulance (see Figure 2).

The safety strap for stowed position is hidden from operator's view while the operator is attaching or unattaching the strap hook.

Sharp edges on steps have caused lacerations of the operators' hands.

The stair support cables have come off of their attachment fasteners (see Figure 2).

The mini-ambulance step seat (used while steps are in stowed position inside the van) restricts the headroom of a seated aidman.

Probable cause. The step latch hardware malfunctions when fouled with dust. The motion to actuate the release lever is lateral to operator's frontal plane and is difficult to grasp and to release. The stair support cable loops wear, increasing their diameter and allowing them to come off their mounting fasteners (see Figure 3).

Implications. A malfunctioning release latch slows the operator's ingress or egress and has caused finger and knuckle injuries. Attaching and disconnecting the safety strap slows the operator's ingress or egress. The sharp edges also cause numerous hand lacerations. Unattached stair support cables could lead to severe injury. The lack of head room available for the stair seat in mini-ambulance could cause severe head or spinal injury. The noisy spring assist may increase the possibility of detection when quiet operations are in effect.

Potential solution. Design the latch with an increased compound lever advantage. Change the direction of the release motion 90 degrees to existing. Move litter support strap to avoid interference.

Design a positive latch lock to eliminate the safety strap requirement. Integrate a dual latch system for both sides of the step that mounts to the steps with a single release handle. This would move the step striker from the steps to inside the van. (AM General installed a dual latch system at the end of the operational test; no functional data is available.)

All sharp edges should be eliminated.

Stair support cables could be redesigned to incorporate the cable and eyelet (see Figure 2).

Add a warning to the operator's manual and locate a warning at the stair seat to avoid possible injuries.

Consideration should be given to the necessity of a rear stair seat.

Data source. Interviews with crew members and AM General personnel; AM General vehicle manuals; field observations.

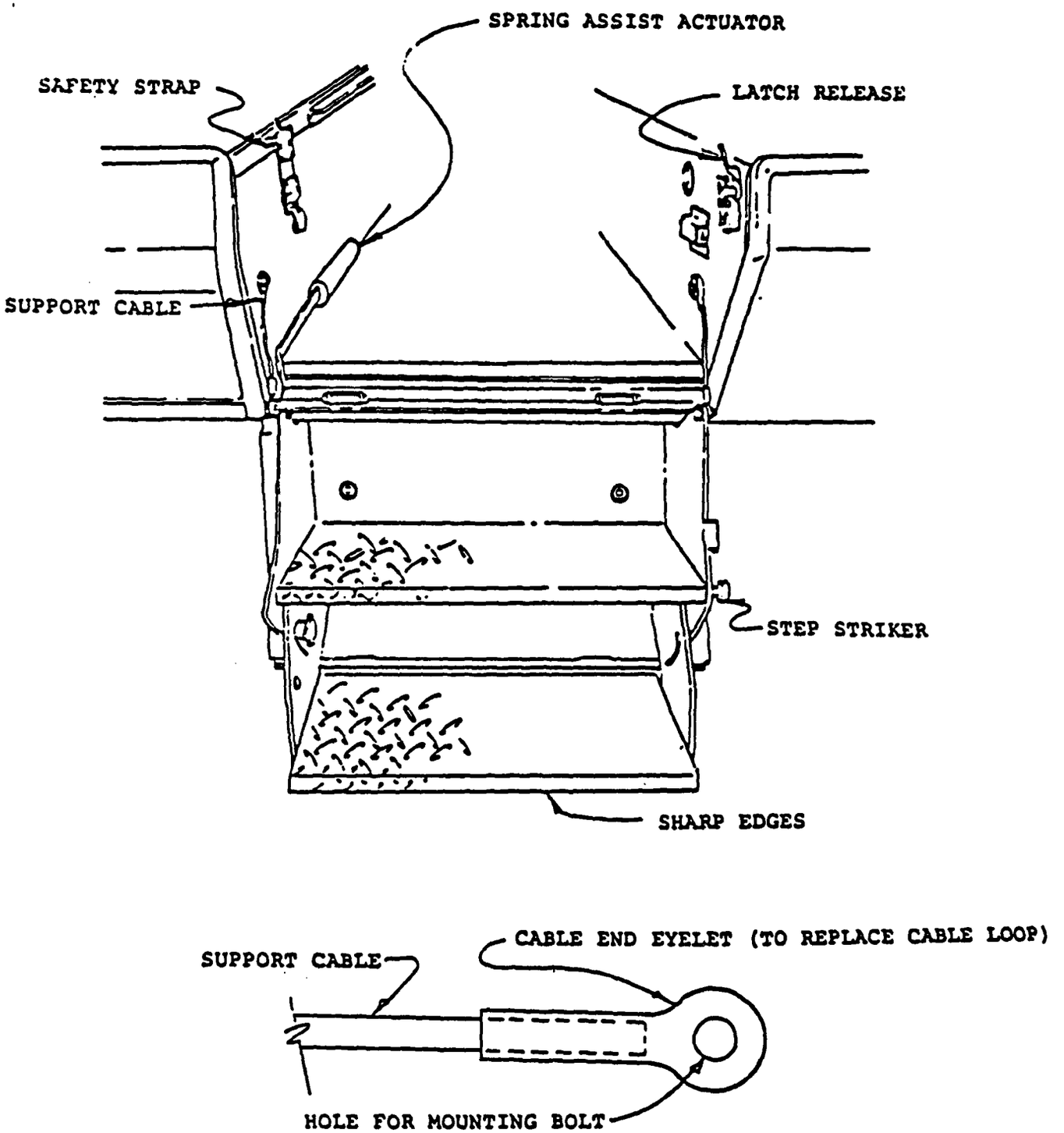

Figure 2. Rear entry steps

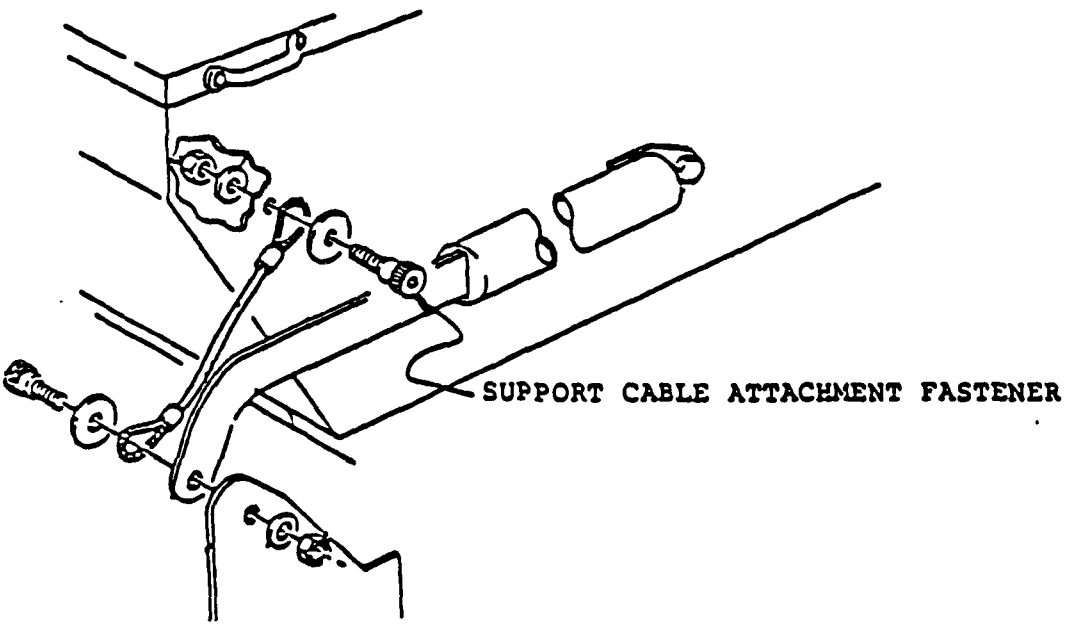

Figure 3. Support cable

Aidman and Ambulatory Patient Securing — Detailed Description 3 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Safety & Health Hazards

Description of the problem. Aidmen and ambulatory patients in the mini- and maxi-ambulances are thrown from their seats while the ambulance negotiates cross-country terrain. Two factors contribute to this problem:

The high mobility of the vehicle and lack of seat belts causes unrestrained ambulance compartment passengers to be thrown about the rear by the shifts and displacements of the vehicle.

Inadequate handholds in number and design do not allow passengers to secure themselves.

Probable cause. The HMMWV-HV ambulances are capable of negotiating cross-country terrain at higher speeds than achievable by previous ambulances. This capability generates greater turbulence for passengers in the ambulance compartment. Unexpected road hazards can also create conditions that will throw and injure an unrestrained passenger.

The maxi-ambulance has an inadequate number of handholds available for ambulatory patients. When eight wounded are sitting, four on each side, facing each other, only the four wounded sitting at each corner have the folded upper litter securing straps to hold on to. The four center seated wounded have no designated/safe handholds.

The mini-ambulance has handhold straps for use by seated ambulatory patients. The securing fasteners frequently failed, rendering the strap useless. It is also difficult to slide hands in and out of the hand strap loop (see Figure 4).

Implications. Ambulatory patients or passengers thrown from their seated position may aggravate their injuries or cause additional injuries.

Ambulatory patients or passengers in the maxi-ambulance seated in the four center locations can hold onto the litter structure behind them or hold onto the passenger next to them. This situation can cause hand lacerations from the litter structure or result in injuries from holding onto other wounded or passengers.

Failure of hand strap fasteners in the mini-ambulance render the strap useless and require a maintenance action to repair. Strap loops that are difficult to pull hands free from slow egress and could result in injuries if wounded are thrown while hands remain secured in the hand strap.

Potential solution. Incorporate a self-winding (retractable) seat belt restraint into the split between the seat and back of the ambulatory seat in the mini-ambulance. Incorporate this seat and restraint system into the maxi-ambulance so the upper litter rack could tilt up to provide a storage area for ambulatory patient personal gear.

Add four handhold straps into the maxi-ambulance similar to the hand straps in the mini-ambulance. This will augment the existing four handholds provided by the looped upper litter support straps.

Incorporate a handhold system such as a continuous handhold strap as shown in the lower portion of Figure 4. This will give aidmen a handhold while attending to upper litter patients in the maxi-ambulance.

Upgrade hand strap fasteners in the mini-ambulance.

Data source. Crewmen interviews, HFE observations, and RAM incident reports.

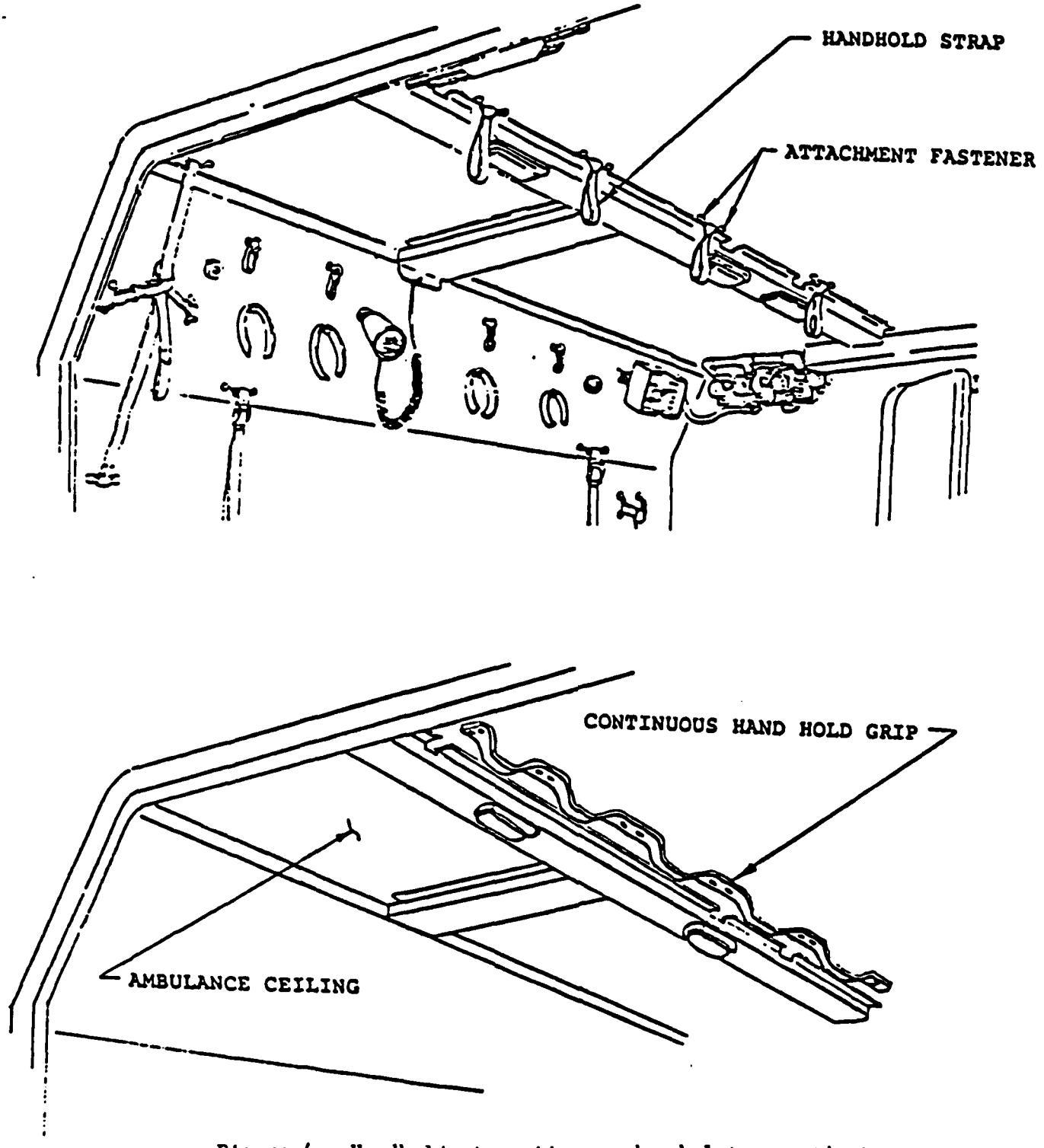

Figure 4. Handholds for aidmen and ambulatory patients

Sharp and Abrading Surfaces. Detailed Description 4 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Safety & Health Hazards

Description of the problem. Sharp or abrupt edges that exist in the mini- and maxi-ambulances and pose a safety hazard to operators and patients. Locations of sharp or abrupt edges are as follows:

Maxi-ambulance (see Figures 5 and 6):

- Edges of aspirator/resuscitator stowage tray.
- Edges of upper litter rack metal structure.
- Inside edges of partially rolled edge of stowage area/litter area partition.
- End of light bar structure next to air conditioning outlets.

Mini-ambulance (see Figures 7 and 8):

- Top back corner of ambulatory seat back when the seat is in the up position.
- Litter deck corner next to the ambulatory patient folding seat back when the back is in the up position.

Both mini- and maxi-ambulances (see Figure 9):

- Litter ramp guide rails.
- Edge located at attendant seat for retractable steps.
- Edges of attendant seat rails.
- Edges of stowage brackets for aidman's seat.
- Edges on step release lever.
- Lower front corner of drivers and passengers door window frame.

Probable cause. Manufacturing processes that leave an unfinished edge and corners of equipment where projections are not padded or broken.

Implications. Sharp or abrupt edges and insufficient padding may result in injuries such as lacerations or contusions to operators and passengers. Insufficient padding leads to operator fatigue and reduced performance.

Potential solution. Roll all sheet steel edges. Round off or break all appropriate sharp corners.

Additional padding for operator or patient safety and/or increased comfort is requested in the following areas:

- Contour seating or increased padding for passengers and drivers seats.
- Increased padding for aidman's seat.
- Padding for ambulatory patients seated in the maxi-ambulance.
- Padding added to the head board structure to protect litter patients' heads in the mini-ambulance.

Data source. Interviews with ambulance aidmen, drivers, and patients.

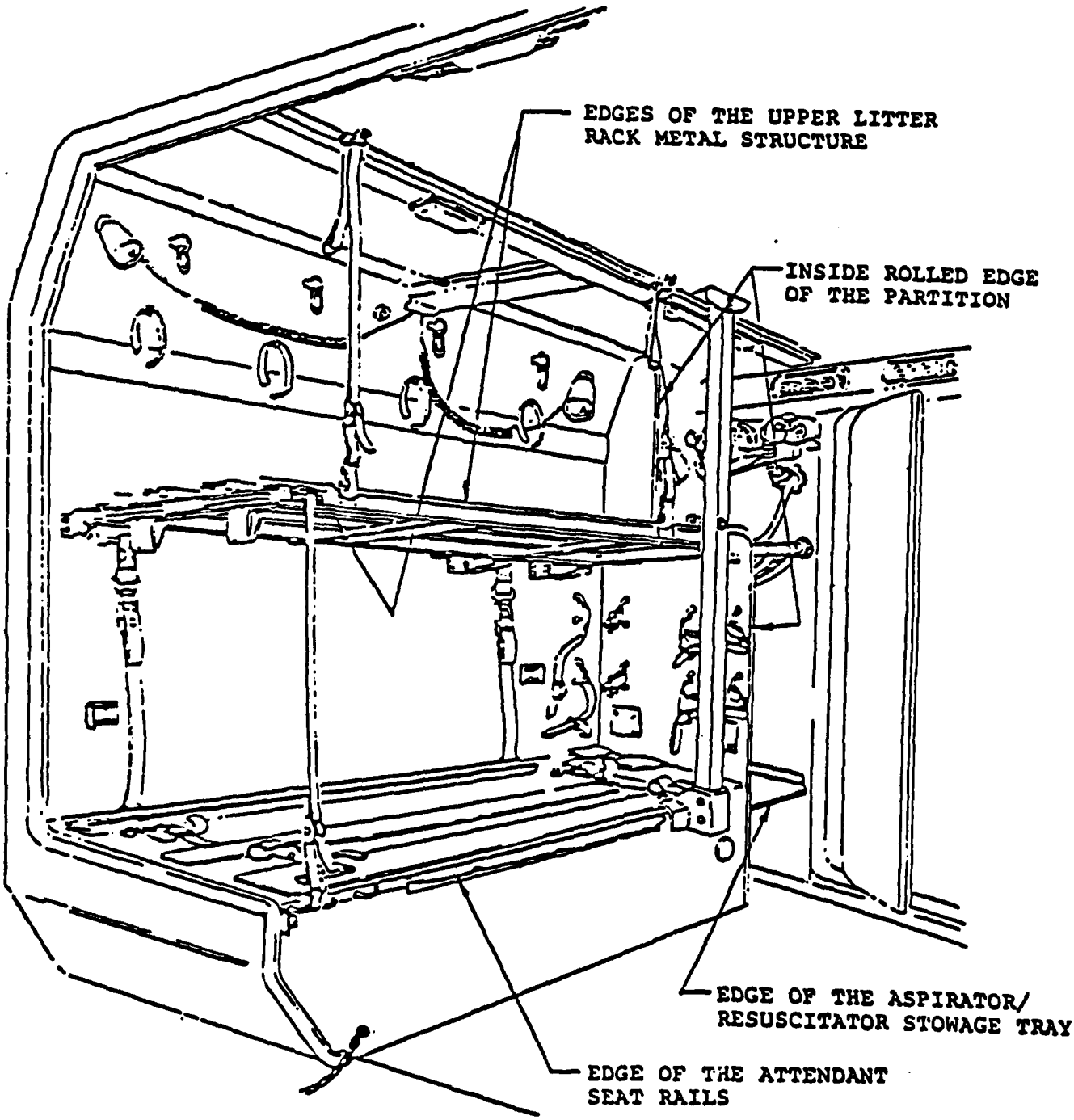

Figure 5. Sharp edges, left side of maxi-ambulance

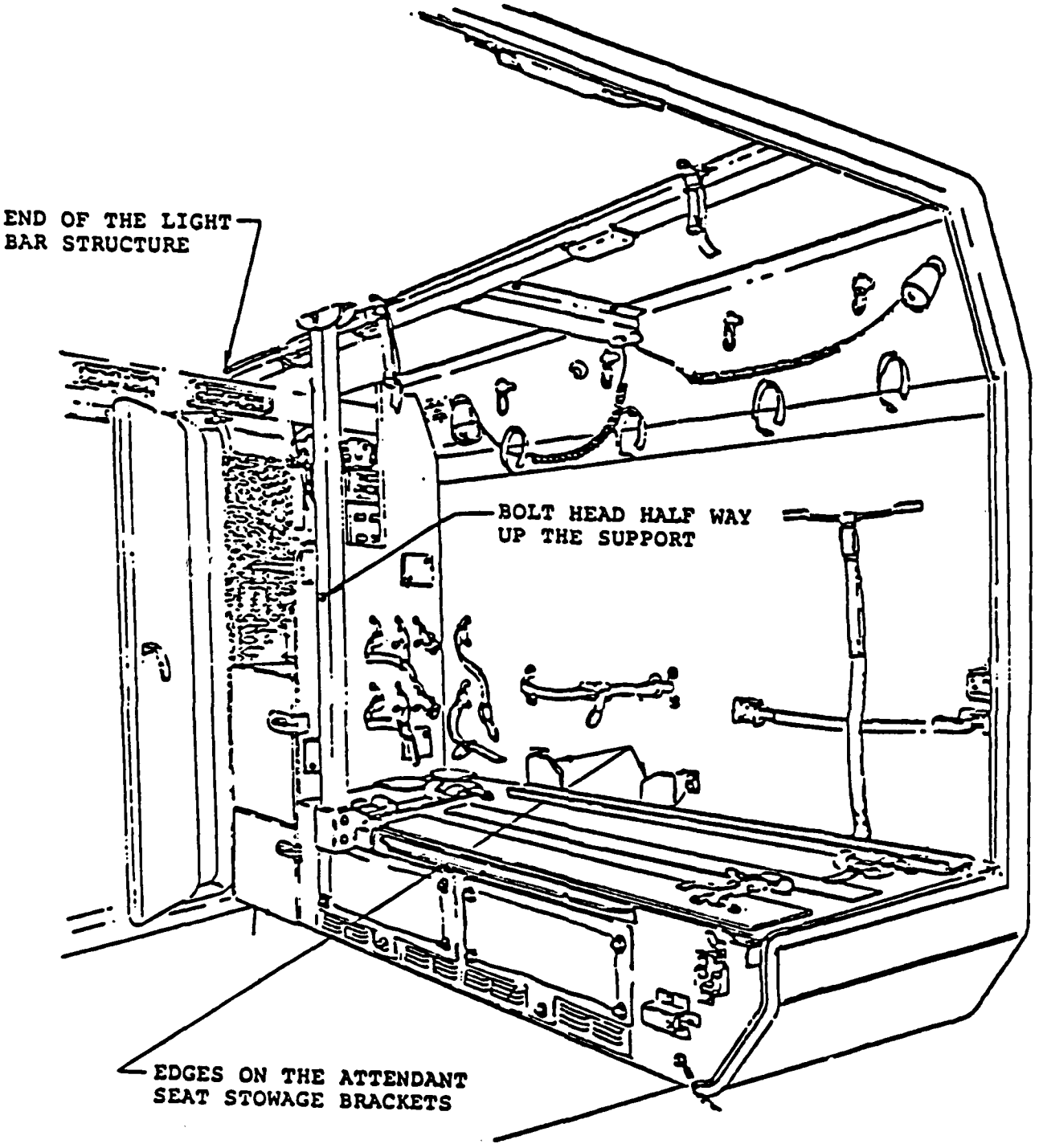

Figure 6. Sharp edges or abrasive surfaces, right side of maxi-ambulance

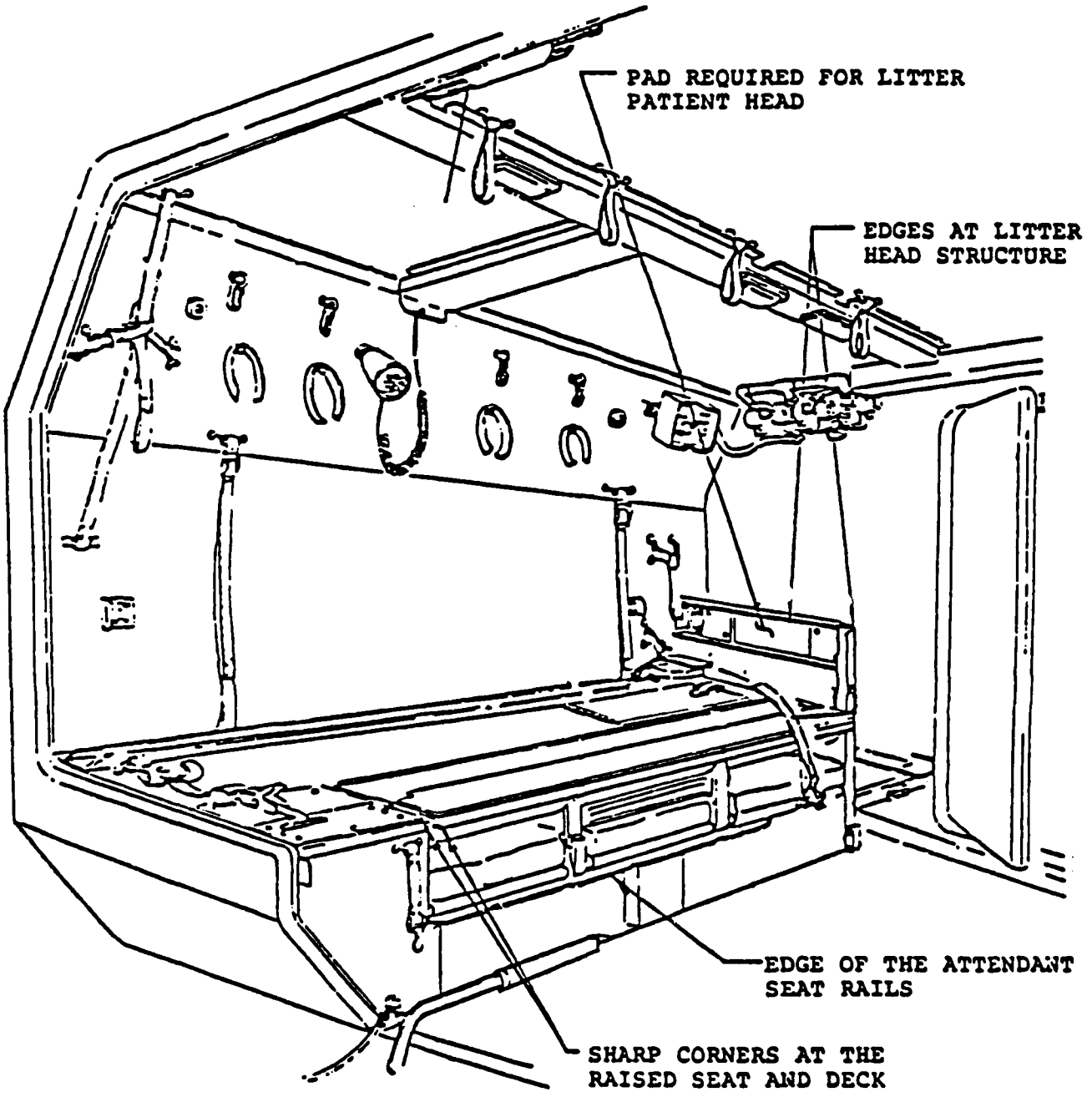

Figure 7. Sharp edges and corners, left side of mini-ambulance

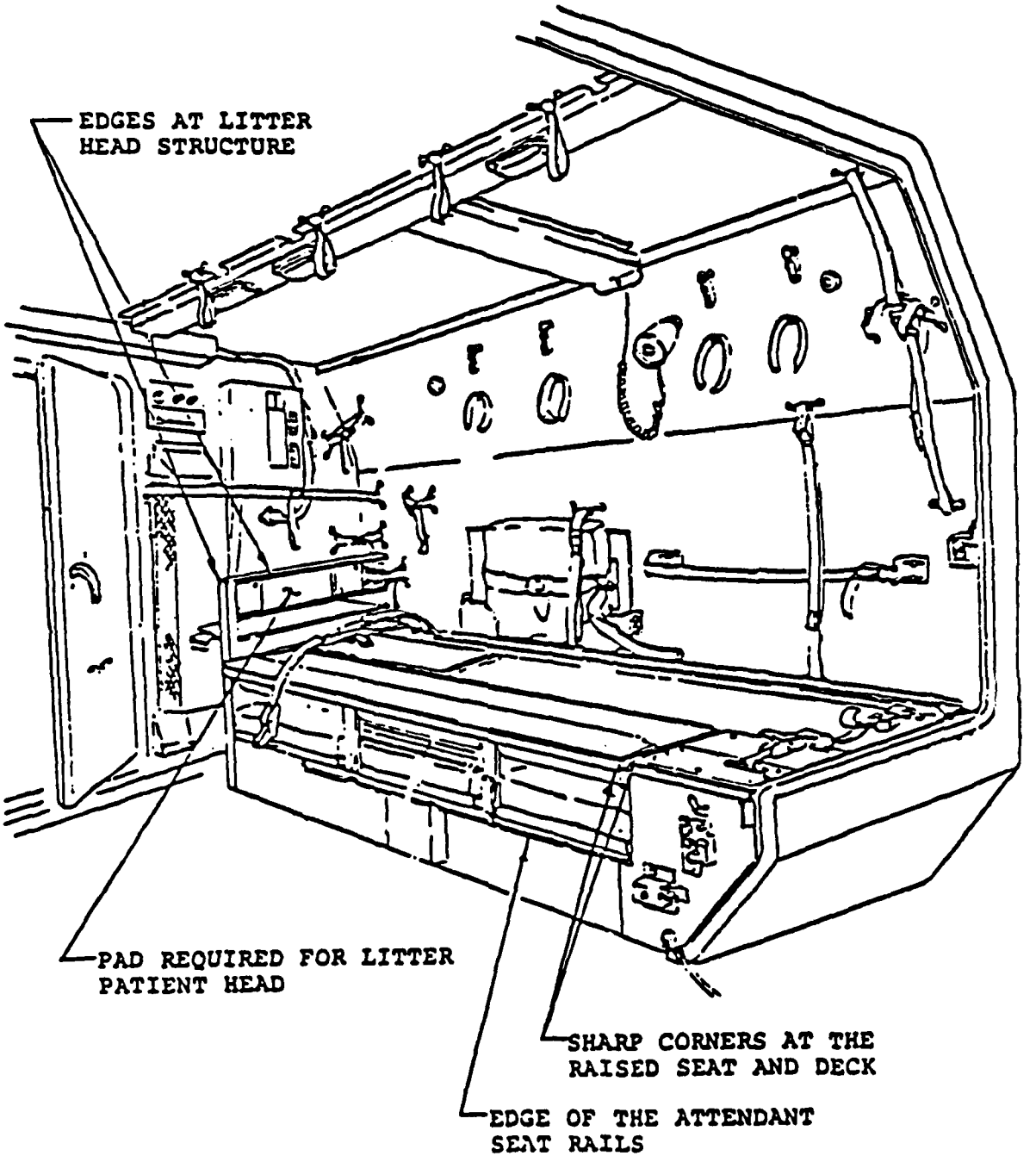

Figure 8. Sharp edges and corners, right side of mini-ambulance

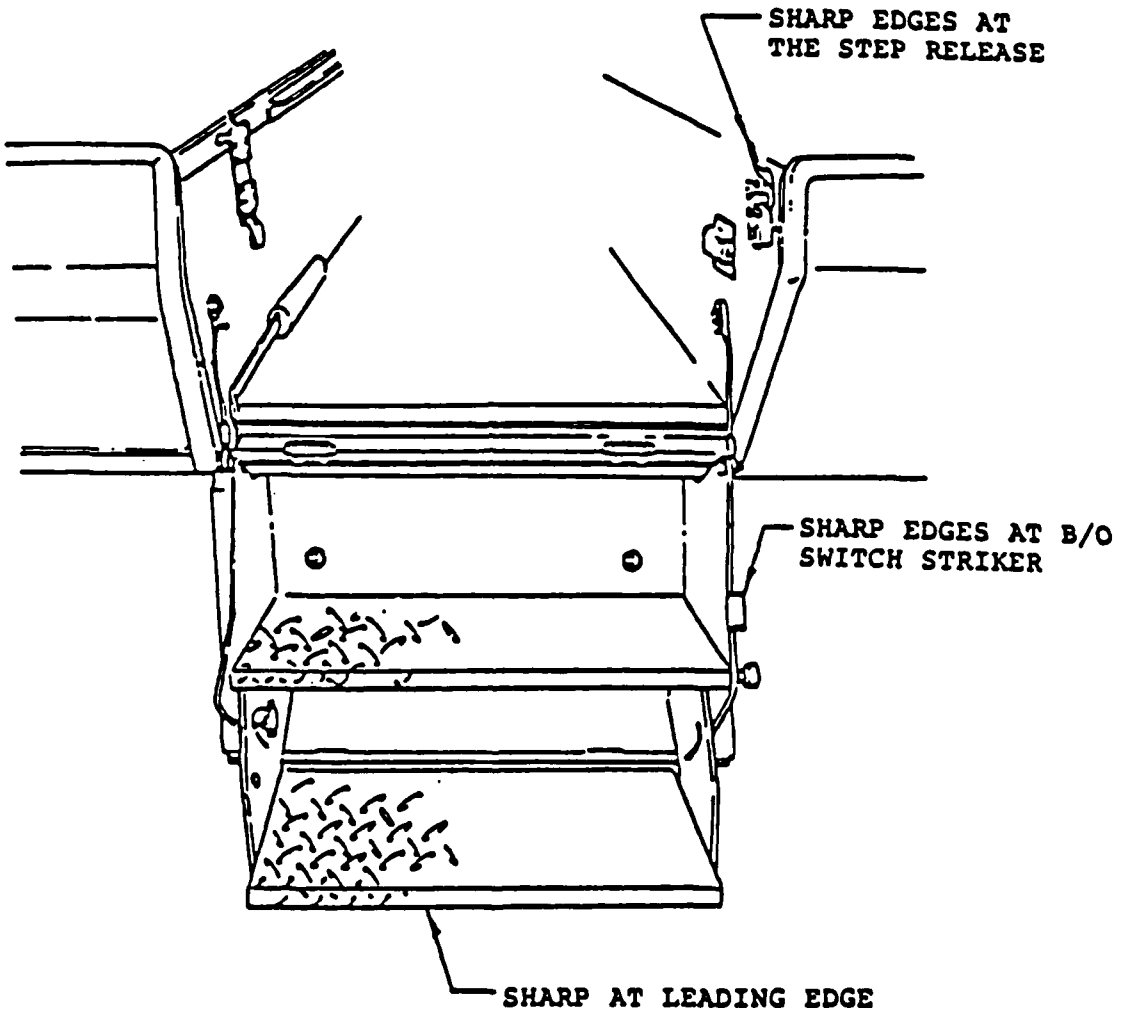

Figure 9. Sharp edges, rear steps of ambulances

Aidman Sliding Seat — Detailed Description 5 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Safety & Health Hazards

Description of the problem. The attendant seat cannot be locked into a position on its slide track so that the attendant can straddle the seat and work at a patient's head. Attendants are also pitched backward and out of the attendant's seat. Aidmen cannot access the upper litter patient in the maxi-ambulance while secured to the aidman's seat. The seat is covered with an absorbent material (see Figure 10).

Probable cause. Operational use requires additional consideration be given to the design of the seat for aidman activities.

Implications. Attendants commonly straddle the attendant's seat but must lean awkwardly to access the patient's head, thus decreasing attendant's effectiveness and comfort. Lack of back support for the attendant's seat allows the attendant, with or without the seat belt, to slide and fall backwards out of the seat when the vehicle travels on rough roads or during hard forward vehicle accelerations. The absorbent seat covering allows contaminants to penetrate and remain lodged in the seat. This condition will make cleaning of biological materials or other contaminants, without replacing the cushion, extremely difficult. The aidman must leave the attendant seat to access upper litter patients. This can result in injuries to aidmen from being thrown about the ambulance compartment.

Potential solution. Put additional detents into the seat slide track, especially one extra set of detents located directly between the two forward detent sets. Incorporate a folding short lumbar support into the attendant's seat. The back of this folding support, when folded down, could be padded to allow the attendant to also straddle the seat. The folding back could be spring-loaded so the back would fold down when not in use to facilitate stepping over it. Cover the seat with a heavy non-permeable vinyl covering. Incorporate a handhold strap system in the maxi-ambulance to give aidmen a secure handhold.

Data source. Attendant interviews and observations by HFE personnel.

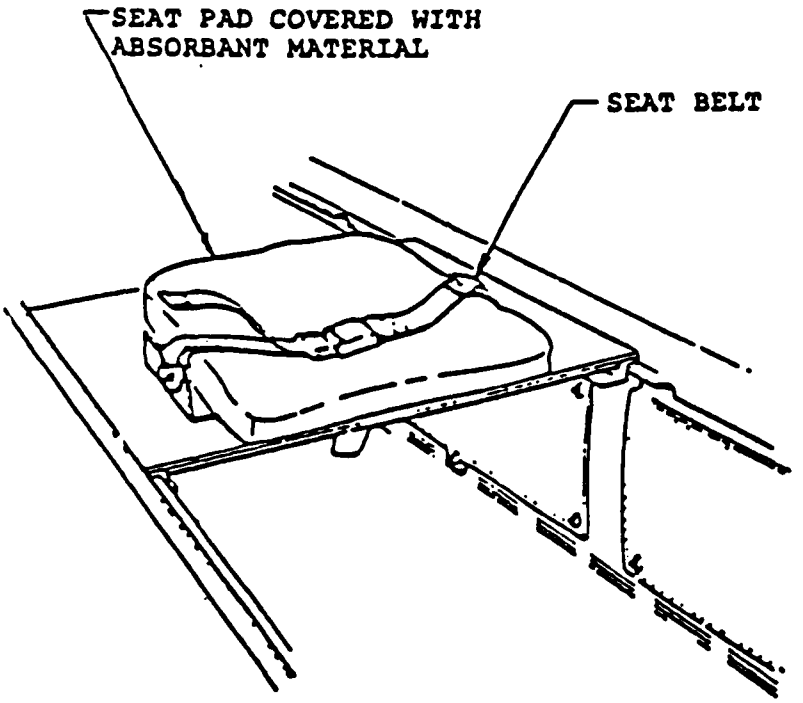

Figure 10. Sliding seat for aidman

HMMWV-HV Shelter Carrier Soft Top Detailed Description 6 of 17.

System: ___ Maxi-Ambulance
___ Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Safety & Health Hazards

Description of the problem. The soft top system for the HMMWV S-250 shelter carrier has deficiencies including:

The rear curtain is loose and flaps excessively leading to high noise levels in the cab.

The curtain does not seal tight behind the crewmen and at the door frames allowing dust and water to enter.

Door latch handles are prone to unlatching (see Figure 11).

Side visibility is distorted due to reduced transparency of the side plastic windows. The plastic windows also prevent optimal use of the side mirrors when the windows are in the up position.

Probable cause. There are insufficient properly located tie down points to adequately fasten the curtain.

The door fits poorly with respect to the door frame and associated gaskets.

Door handles and hardware are too flimsy.

Plastic windows are translucent distorting clear vision.

Implications. Insufficient tension allows the curtain to hit the crewmen in the back of their heads. Poor seals allow dust, cold drafts, and water to enter the crew cab. Doors have inadvertently opened during cross-country travel, distracting the operator and resulting in reduced vehicle control. The plastic windows defeat use of the side mirrors and reduce rearward vision.

Potential solution. Incorporate adjustable cinch straps to adjust back curtain tension. Improve door frame fit and gasket seals. Improve the catch on the interior door handle by increasing the side of the molded catch. Relocate the side mirrors to a position forward to allow the driver to use the mirrors through the windshield. Incorporate a transparent, hard, clear window.

Data source. Interviews with crewmen.

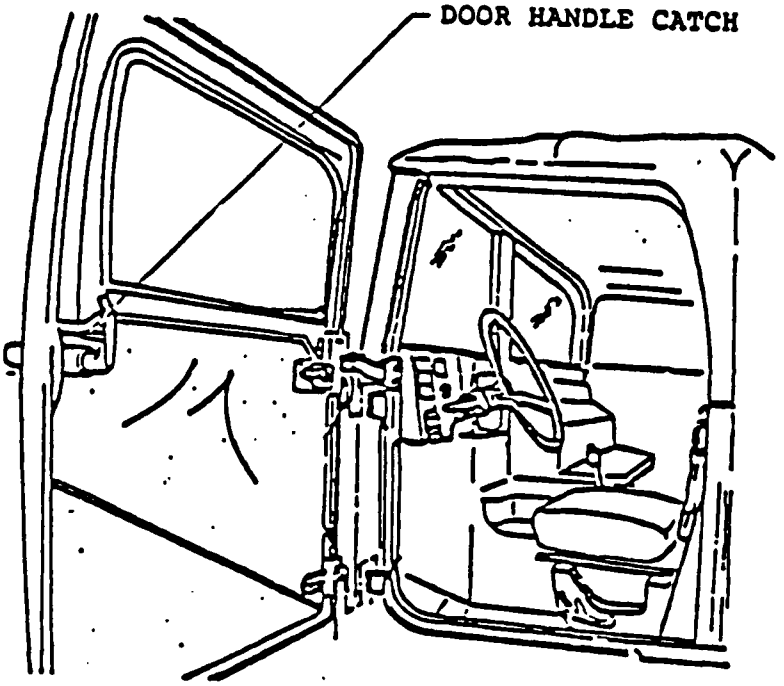

Figure 11. Door latch handles

Shelter Carrier Tailgate Tripping Hazards — Detailed Description 7 of 17.

System:
___ Maxi-Ambulance
___ Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Safety & Health Hazards

Description of the problem. A tripping hazard exists for HMMWV-HV shelter carrier crewmen while entering or exiting the communications (S-250) shelter. Two hazard locations are shown in Figure 12: one, a gap between the tailgate when lowered and the rear shelter bed cross support member; two, a gap between the bed of the vehicle and the lower edge of the shelter.

Probable cause. Addition of the tailgate extension bracket results in the large gap. The shelter reinforcement bracket lifts the shelter allowing the second gap.

Implications. The tailgate gap is large enough that a soldier's boot could lodge in the opening. A soldier when exiting the shelter and with his boot pinned in the gap could fall from the tailgate to the ground. Severe injury may occur to the soldier during such a fall.

A soldier's boot could become lodged in the gap between the lower edge of the shelter and the vehicle bed. This may occur while a soldier is entering the shelter, causing him to trip and incur an injury.

Potential solution. Add a horizontal plate attached to the shelter bed cross support member to fill the gap between the cross support member and the tailgate. This plate would be fitted to the cross support member.

Data source. Shelter crewmen interviews and HFE observations.

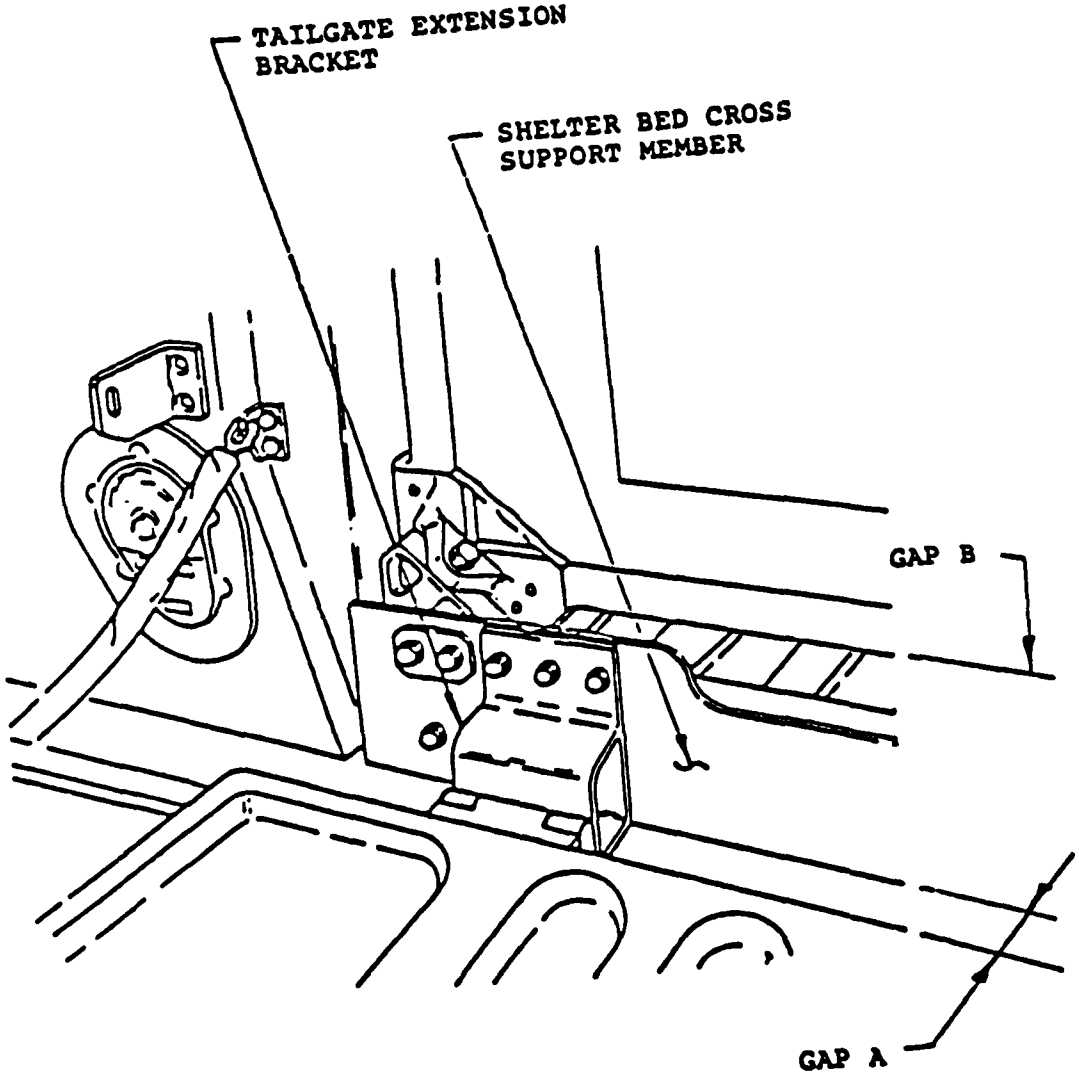

Figure 12. Shelter and tailgate tripping hazards

Dust in Ambulance Compartment — Detailed Description 8 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Safety & Health Hazards

Description of the problem. Excessive dust enters the rear compartments of the maxi-ambulance and the mini-ambulance. This condition is caused by the following:

Dust enters through ineffective seals at the rear door gaskets and the retractable stair gaskets.

Dust comes in through the rear door vent if opened for use.

Dust comes in through the ventilation system when used to obtain outside fresh air.

Dust from the cab enters through the bulkhead doors into the patient compartment.

Probable cause. A large percentage of dust enters the vehicle through the front windows. These windows are usually kept open so operators can keep the cab temperature within acceptable comfort limits. Dust also enters the rear ambulance compartment through the bulkhead door seals. The problem is increased if the bulkhead doors are in their open position. These doors are often kept open to allow the aidman to communicate with the driver and to see outside the vehicle. Attendants desire to see outside the vehicle to avoid nausea caused by motion. The air conditioning system in the maxi-ambulance can only be used to limit the amount of dust entering the ambulance compartment. To accomplish this, the system must be set to recirculate interior air and the bulkhead doors must be closed. Even during these operating conditions, dust still gets past the aforementioned seals. This mode of operation is not available for the mini-ambulance which does not have air conditioning.

The rear door and stair gaskets do not provide a positive seal, allowing dust to get past them.

When the ventilation system is set for outside air, a large percentage of dust enters through the vents. This system setting is avoided by the crew, especially when traveling in convoy. The consequences are high interior temperatures decreasing crew effectiveness.

Dust comes in through the rear door vent even while the ventilation fan is on high while this vent should be acting as an exhaust. This vent's use is avoided.

Implications. Dust will contaminate patient injuries. Dust may complicate respiratory injuries. Dust will hinder breathing for crewmen and patients.

Potential solution. Incorporate a dust separation filter for ambulance compartment outside air intakes. Develop better seals for the rear door, rear stair, and bulkhead door.

Data source. Ambulance crewmen interviews and HFE observations during field exercises.

Visibility from Driver's Position — Detailed Description 9 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Human Factors

Description of the problem. The width of the HMMWV and non-sloping hood reduce the driver's visibility to see critical frontal areas of the vehicle. The lack of driver's seat adjustment locations contribute to this problem and also leave many drivers with insufficient leg room. The three available seat adjustment positions are shown in Figure 13. Interviews with drivers have provided the following:

Drivers in height ranges of approximately 71-75 inches (177.5-187.5 cm) adjust the seat in the back position. These drivers claim they require 1-4 inches (2.5-10 cm) of additional elevation to aid in greater visibility.

Drivers in height ranges of approximately 67-71 inches (167.5-177.5 cm) adjust the seat in the middle position. These drivers complain their knees hit either the throttle control knob or hot engine cowling.

Drivers in height ranges of less than 69 inches (172.5 cm) adjust the seat in either the front or middle position. Small operators with long legs use the middle seating position. These operators claim they are 1-4 inches (2.5-10 cm) too low for optimum visibility. If they use the front seating position, their legs hit the throttle control knob or hot engine cowling.

Driving incidents resulting from the lack of visibility of the front right corner or front of vehicle due to the operator's poor seating position include:

Vehicle B02, Cracked right front of hood during cross-country driving.

Vehicle B01, Hit low stump with right front tire dislodging the air cleaner attached inside the fender.

Vehicle C02, Hit low stump with right front tire dislodging the air cleaner and bending the tire rim.

Probable cause. Limited adjustability of seat adjustment device.

Implications. There is poor visibility of critical frontal areas, such as low and close to vehicle directly in front, and in the right front quarter area.

The operators' legs are cramped into dash, allowing their knees to hit the throttle control.

Operators increase height by adding or packing gear below driver's seat pad. This improper use of equipment leads to unstable seating position, and reduces the effectiveness of the seat belt.

Potential solution. Redesign driver's seat to either adjust independently for up and down and front to back, or to increase adjustment positions of existing design.

Data source. Interviews with three crews involved in the incidents described above. Interviews with shelter carrier and ambulance drivers.

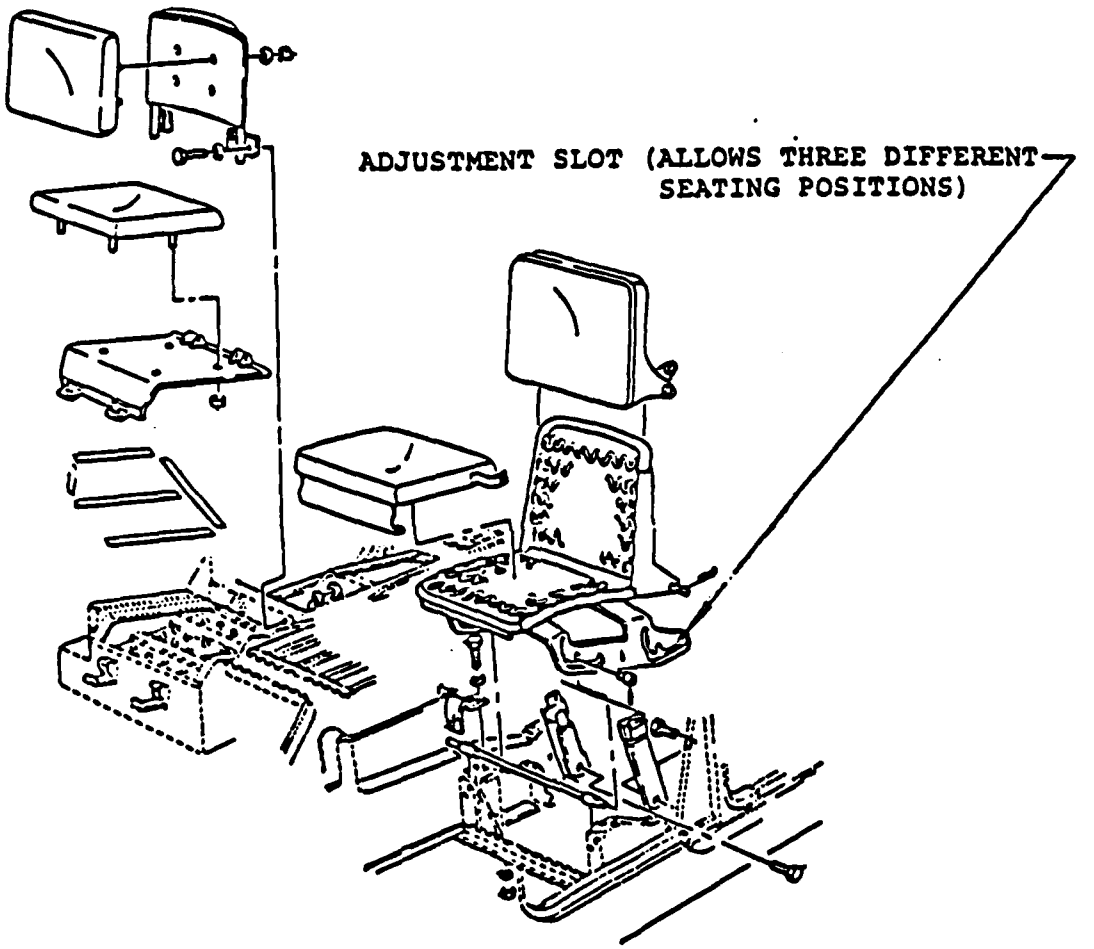

Figure 13. Driver's seat adjustment slot

Litter Loading and Unloading — Detailed Description 10 of 17.

System:
X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Human Factors and Training

Description of the problem. Litter bearers have difficulty loading and unloading litter patients from the maxi- or mini-ambulances. It is difficult to secure the litters inside the ambulance with the litter securing straps. Litters are difficult to secure while loading in the tilted upper litter berth of the maxi-ambulance.

Probable cause. The litter bearers' ability to load and unload litters is decreased by (see Figure 14):

- The presence of sharp edges along the length of the litter ramp rails.
- Litters catching on the litter securing straps while loading.
- The cross support structure at the base of the litter ramps trip litter bearers while loading.
- The litter ramps can become disconnected from the vehicle; by disruption when aidmen set and align the litter on the litter ramp, and when the ramp is set up on uneven ground.

Adequate securing of the litter is not accomplished by the litter securing straps due to: 1) the difficulty of locking the securing straps and setting sufficient strap tension, and 2) the securing strap hooks slide down the tapered litter handles and come loose.

To secure the upper litter while loading, the aidman must reach over the litter bearer who is holding up the tilted litter. This is further complicated by the difficulty in achieving proper tension with the securing straps.

Implications. Sharp edges cut the aidman's hands while lifting the litters away from the ramp rails and while litters are slid up the ramp. Aidmen may lose control of the litter due to either the ramp disconnecting from the vehicle or their tripping over the structure at the ramp base. Litter loading is delayed due to the interference caused by the litter catching on the litter restraint straps.

A litter strap malfunction may result in an unsecured litter. Setting the litter strap tension is slow. Operators must first guess at the proper adjustment for the strap and then clamp the device. If the tension is guessed wrong, the procedure must be repeated.

Difficulty securing upper litter patients while loading in the maxi-ambulance slows the patient loading process.

Potential solution. Litter ramp rail edges should be rolled. The litter ramp attachment to vehicle lugs should be altered to increase their ability to stay secured. Loading procedures should be revised to have litter bearers load litters using a side-carry loading method. This method would avoid the litter ramp structure tripping hazard and would also allow for both litter bearers to apply the lifting and pushing forces required to load the litter.

Incorporate a litter-securing device that first clamps to the litter, and second, allows litter securing tension to be applied.

Data source. Crewmen interviews and HFE observations.

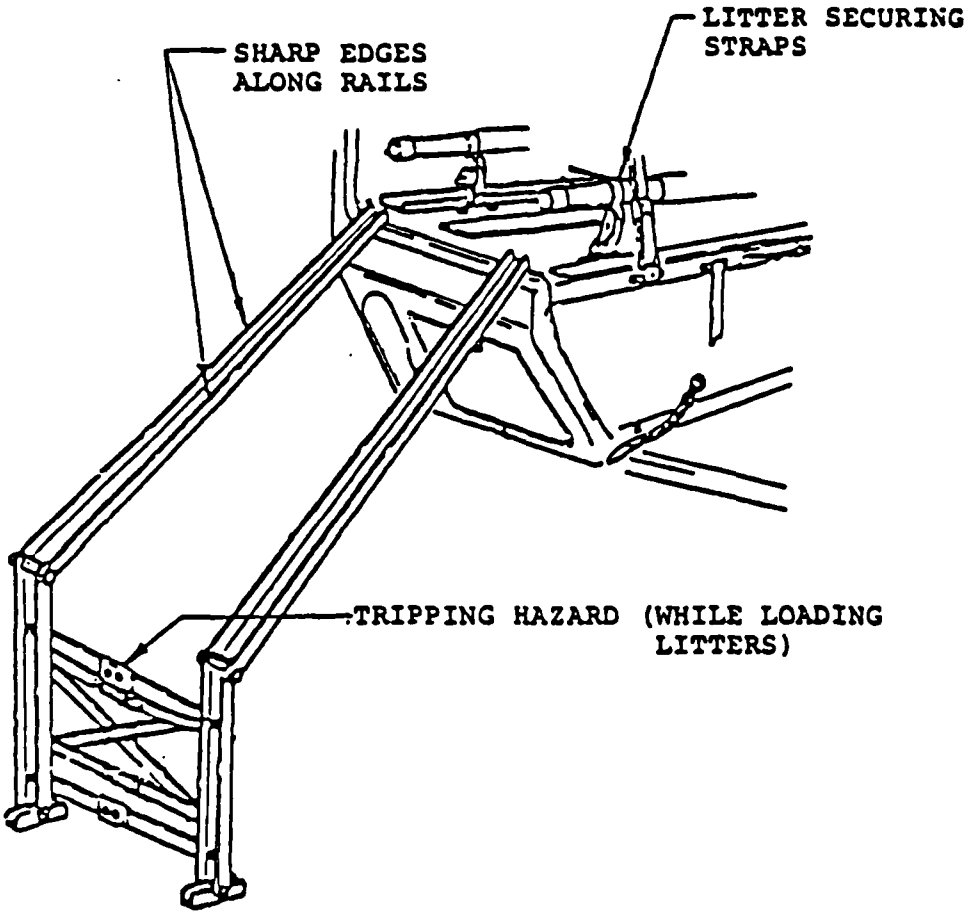

Figure 14. Ramp for loading and unloading litters

Rear-View Side Mirrors

Detailed Description 11 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Human Factors

Description of the problem. The side mirrors on the HMMWV ambulances and shelter carrier are too small and vibrate excessively. The hardware for mirror adjustment to the window frame mount vibrates loose, and the mirror falls to the side of the vehicle due to the length of the support. Operators claim the passenger side mirror is poorly positioned and does not provide a view. Shelter carrier drivers complain they do not have adequate rearward view to monitor their trailer status.

Probable cause. The mirror is supported by a single support that is approximately 20 inches (50 cm) long and is cantilevered from the mounting and adjusting hardware (see Figure 15). Vibration acting on the same plane as the adjustment nut tends to loosen the nut.

Implications. Excessive vibration blurs operator's rearward view. Loose hardware disables the use of the mirror. The small size of mirrors, about 5 by 7 inches (12.5 by 17.5 cm), limits effectiveness.

Potential solution. Increase support of the mirror by adding an extra support member in a triangular configuration.

Increase size of mirrors. Crewmen would prefer mirrors similar to those found on M35, 2.5-ton vehicles.

Data source. Crew interviews and field observations by HFE.

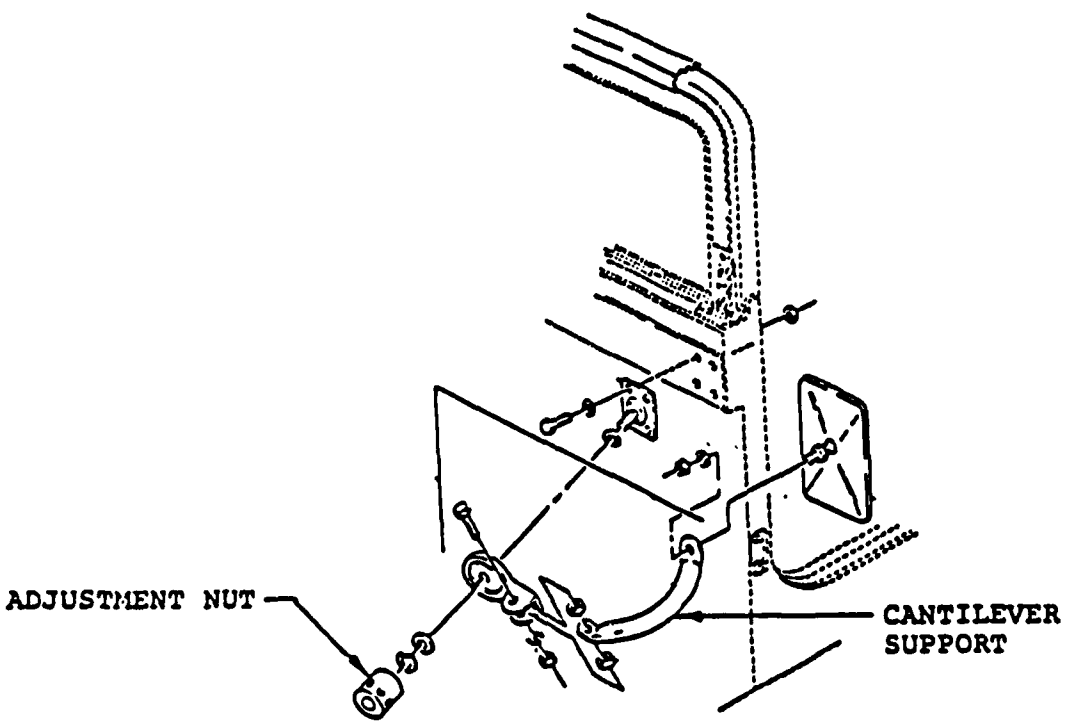

Figure 15. Side-mounted rear view mirror

Aidman Performing Tasks in a Moving Vehicle. Detailed Description 12 of 17.

System: X Maxi-Ambulance
___ Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Human Factors and Training

Description of the problem. Aidmen are not able to perform some essential mission functions while the ambulance is traveling. These functions include monitoring patient vital signs and performing CPR between or above the litter racks in the maxi-ambulance.

The stowed small backboard is blocked by the lowered upper litter rack in the maxi-ambulance. It is also difficult to remove if a litter patient is in the lower berth.

Probable cause. A combination of noise and vibration keep aidmen from effective use of the stethoscope and otherwise monitoring vital signs. Noise has been identified to come from the clatter of litter rack hardware, coiled light cords contacting the walls, and IV rings hitting the walls.

There is insufficient room between litter racks to effectively perform manual chest compressions for CPR.

If four ambulatory patients are loaded on the right side of the vehicle and 2 litters are loaded on the left side (looking forward), access to the small backboard is blocked by the right side lowered litter rack.

Implications. Vital signs are necessary to continually assess patient status. Aidmen must monitor patients to determine if further medical aid, including CPR, must be initiated. Fatality may result if patients cannot be monitored.

CPR cannot be initiated or continued while the four litter positions are in use in the maxi-ambulance. If a patient cannot be transported in a maxi-ambulance while CPR is in progress to a higher level of aid, fatality will result.

The small backboard may be required for use by litter patients loaded on the left side of the vehicle. Aidmen will not have access to this equipment if four ambulatory patients are seated on the right side (looking forward). The process of removing the small backboard over a litter patient may cause or complicate injuries to that patient.

Potential solution. Incorporate pads for litter rack, locking hardware to limit noise from vibration. Use a non-coiled light cord with a snap-securing device.

Develop a CPR method to perform manual chest compressions while aidman is offset from the patient.

Relocate the small backboard.

Data source. Aidman and driver interviews, interviews with medical company officers, and HFE observations.

Access to Vehicle Antenna and Roof Red Cross. Detailed Description 13 of 17.

System: ___ Maxi-Ambulance
___ Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Human Factors and Safety

Description of the problem. With the antenna and red cross mounted in the center of the vehicle, there is no safe way provided to climb up to cover the cross or tie down the antenna. Troops climb on hood, trying to avoid no-step points to reach the antenna. Troops have not been able to access the red cross.

Probable cause. Not applicable.

Implications. Falls producing injuries or vehicle damage are likely.

Potential solution. Provide a ladder or hand and toe holds for roof access. Roof stowage of camouflage or other gear would become possible.

Data source. Observation, interviews with drivers and controllers.

Pioneer Tool Rack Attachment — Detailed Description 14 of 17.

System:
X Maxi-Ambulance
X Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Human Factors

Description of the problem. The standard pioneer tool racks that fit the HMMWV cargo or tow will not fit the HMMWV-HV ambulances or shelter carrier. Racks furnished for the ambulances or shelter carrier come with a special angle bracket to adapt the pioneer tool rack to these vehicles (see Figure 16). One ambulance (B02) was issued a standard pioneer tool rack (including tools) which would not fit beneath the ambulance. These tools were stowed inside the ambulance compartment, interfering with personnel movement inside the compartment.

Probable cause. Not applicable.

Implications. Pioneer tool sets will not attach universally to all HMMWV vehicles. Situations as described above will occur.

Potential solution. Attach an adaptor bracket to the HMMWV-HV vehicle instead of the rack so all pioneer tool sets are universal.

Data source. Observations by HFE personnel.

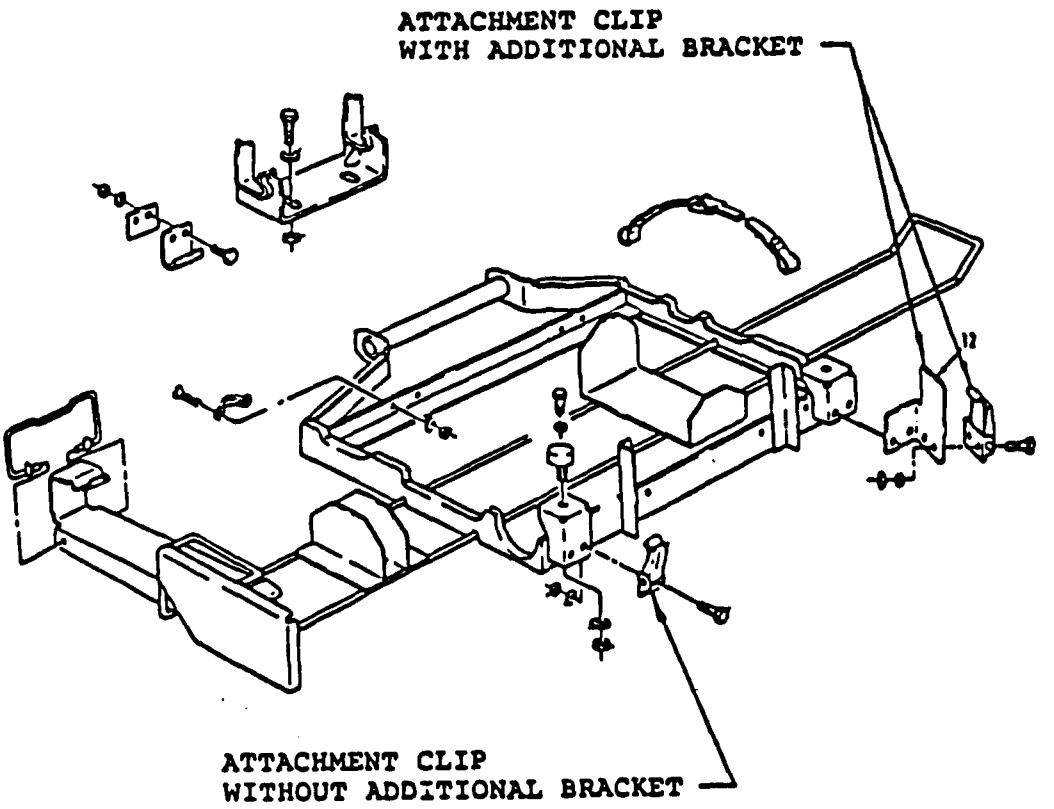

Figure 16. Pioneer tool rack attachment

Shelter Mounting Kit

Detailed Description 15 of 17.

System: ___ Maxi-Ambulance
___ Mini-Ambulance
X S-250 Shelter

MANPRINT Category: Training/Equipment Design

Description of the problem. The mounting kit provided to adapt the S-250 shelter to the HMMWV-HV is not usable for all versions of the S-250 shelter. The mounting kit bolts (Figure 17, Items 2 and 4) behind the cab and passenger seat are difficult to align and start.

Probable cause. Manufacture of the S-250 shelter by different manufacturers. Bolts are difficult to start due to interference by the fixed position passenger seat.

Implications. Some of the S-250 shelters will not fit to HMMWV-HVs with the mounts provided by the manufacturer. Crewmen claim it takes up to three times the amount of time to align and start these bolts.

Potential solution. Design the shelter mount to accommodate both versions of the S-250 shelter. Instruct personnel to remove passenger seat when installing the shelter on the HMMWV-HV.

Data source. Shelter carrier crewmen interviews.

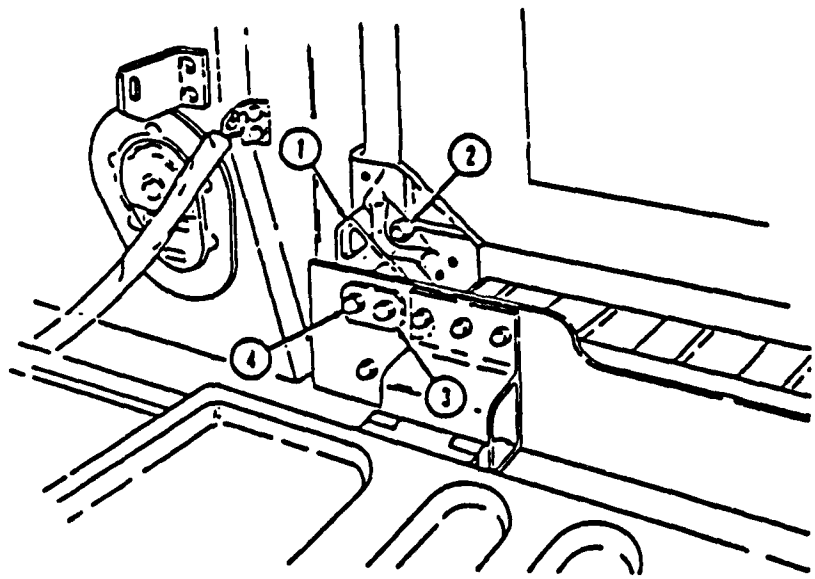

Figure 17. Shelter mounting kit

Oxygen Bottle Racks

Detailed Description 16 of 17.

System: X Maxi-Ambulance
X Mini-Ambulance
___ S-250 Shelter

MANPRINT Category: Equipment Design

Description of the problem. The oxygen bottle rack mounts position the bottles without enough room to allow for the attachment of the yoke adapters. Bottles cannot be put into service in stowed position at present. Only one rack position in the maxi-ambulance (see Figure 18) will allow the O_2 bottle to be made ready (with the yoke attached) for operation while in the stowage rack. There are no provisions to secure oxygen bottles to litters if the oxygen bottles are placed next to patients on litters.

Probable cause. Additional attention needs to be given to operational requirements.

Implications. Oxygen bottles are not usable unless they are removed from rack and cannot be stowed until after yokes are removed. Bottles that are not secured during use or that lie on the patient's litter may be thrown about a moving vehicle and cause injury to aidmen or patients.

Potential solution. Redesign racks with sufficient clearances. Design storage rack straps to also serve as oxygen bottle litter-securing straps.

Data source. Interview with representative of A Company, 209 Support Battalion; field observations; interviews with representatives of AM General.

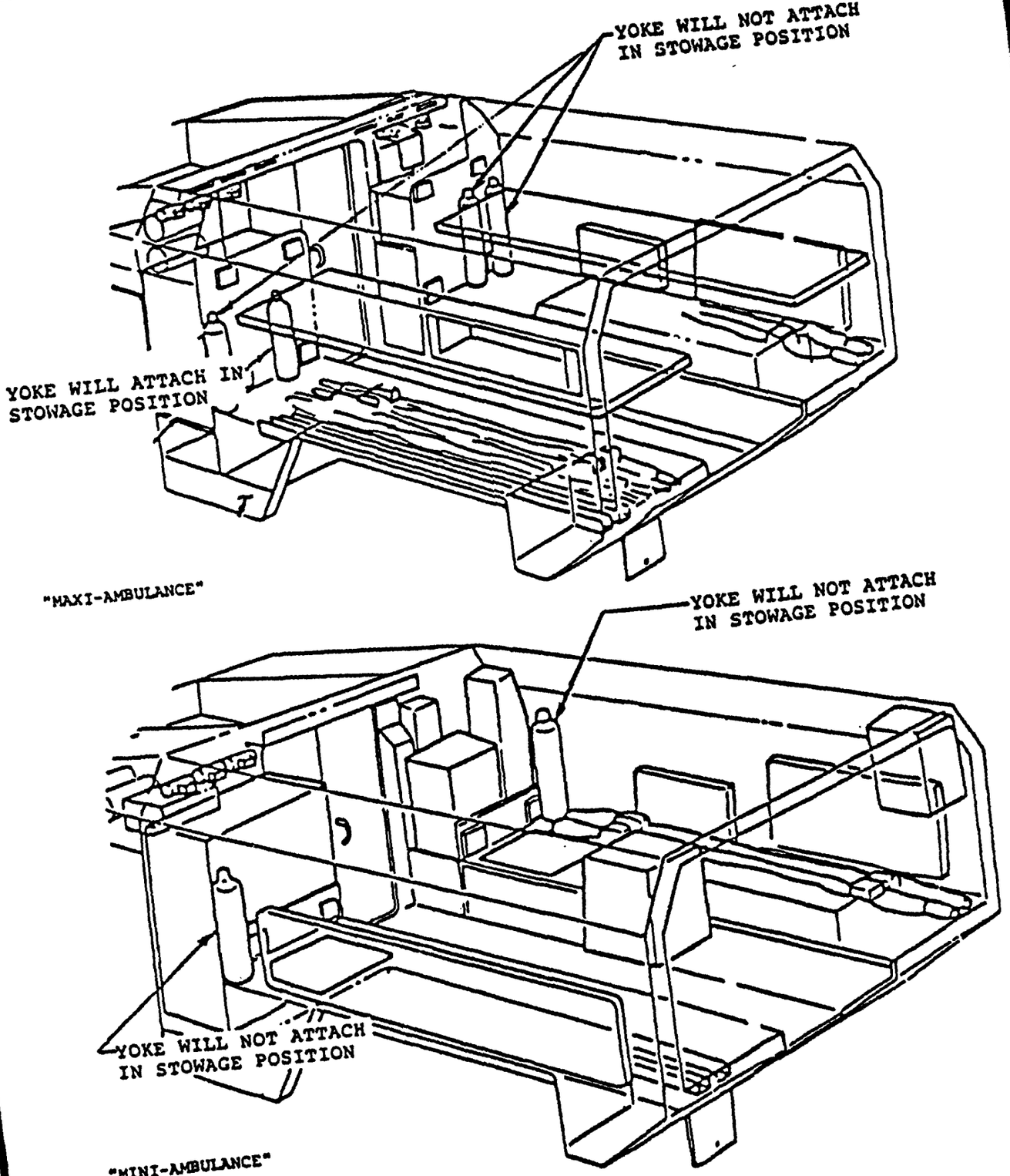

Figure 18. Oxygen bottle racks

Shelter Carrier Stowage — Detailed Description 17 of 17.

System: ___ Maxi-Ambulance
___ Mini-Ambulance
_X_ S-250 Shelter

MANPRINT Category: Equipment Design/Stowage

Description of the problem. Proper stowage of the following items is not provided for on the HMMWV-HV shelter carrier:

a. Fire extinguisher
b. Water jugs
c. Power cable with reel
d. Coax cable with reel
e. Folding chair
f. Dipoles (2)
g. Camo pole bags
h. Camo
i. Ladder
j. Antenna bags (2)
k. Shelter pioneer tools
l. Grounding rods
m. Loose personel heater
n. Personal gear

Probable cause. Insufficient design attention was given to equipment stowage and restraint requirements.

Implications. Equipment that is stowed in the shelter is not restrained and moves freely about the floor of the shelter while negotiating terrain. This movement results in damage to the equipment and a stepping/tripping hazard to anyone entering the shelter. Time and effort are also wasted by crewmen removing heavy equipment from the shelter.

Potential solution. Incorporate storage box compartments to be installed in the area behind the cab on both sides of the HMMWV-HV shelter carrier (Figure 19). The following items could be located in these storage areas:

1) Water jugs
2) Power cable
3) Coax cable
4) Dipoles (TR 113)
5) Personal heater
6) Fire extinguisher

Incorporate a lightweight roof rack including tie down straps. The following items could be stowed on the roof using the rack:

1) Camo pole bags
2) Camo
3) Antenna bags

Shelter pioneer tools may be eliminated due to duplication of HMMWV-HV pioneer tools.

Remaining items including personal gear would continue to be stowed in the shelter.

Data source. Crewmen interviews.

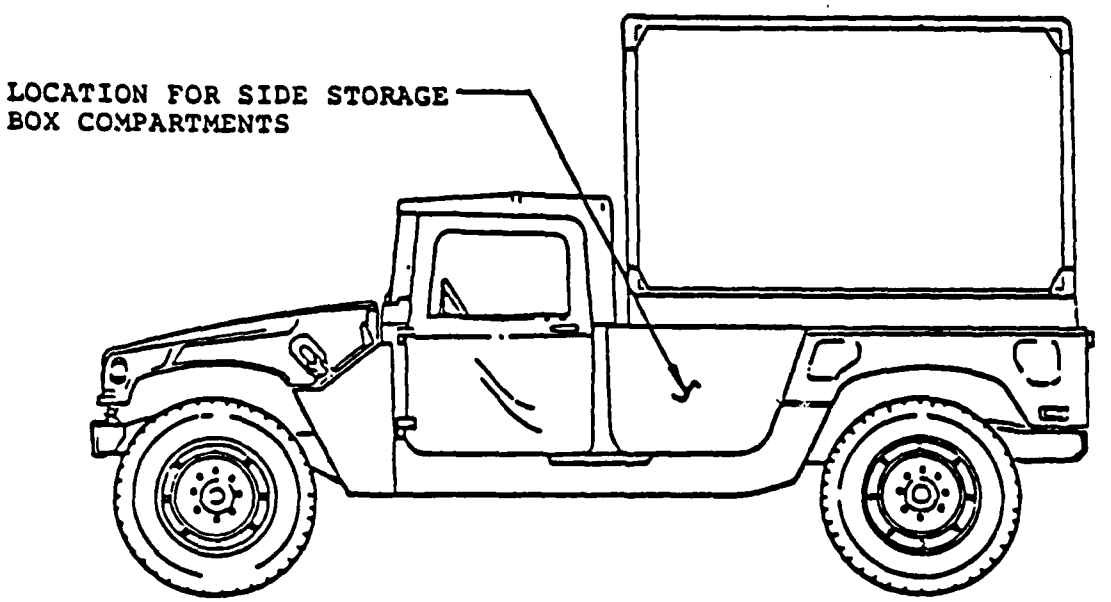

Figure 19. Shelter carrier stowage

Structured Interview and Checklist Data

Data emanating from the administration and data reduction of six structural interview forms and three checklists to five categories of personnel are presented in this section. The six interview forms and three checklists are:

1. Training Interview
2. Aidman Interview
3. Aidman Checklist
4. Driver Interview
5. Driver Checklist
6. Sheltercrew Interview
7. Sheltercrew Checklist
8. Maintainers Interview
9. Key Personnel Interview

Missing question numbers indicate questions not applicable to the data category being discussed (e.g., training interview data presented below starts with question #7).

Training Interview

The numeric figure preceding most questions is taken from the training interview form. In some cases, an unnumbered stem question is presented, and the numbers are associated with the branching or modifying questions. The distribution of interviewee responses of "Yes", "No", and "NA" (for Not applicable) is shown after each question or subquestion in the following format: [Yes = 11, No = 22, NA = 0]. 33 soldiers received the training interview. Subjects answered only those questions applicable to their job (e.g., driver).

7. Was the NET on vehicle controls and indicators/gauges complete and was adequate practice in their use provided? [Yes = 21, No = 2, NA = 10]

   Comments: Haven't driven one as of yet. Have not had sufficient time with HMMWV. Received better training in my own unit.

8. Was NET on preventive maintenance checks and services (PMCS) complete and was adequate practice on PMCS provided? [Yes = 26, No = 1, NA = 6]

   Comments: No PMCS was covered.

9. Was NET on the safety features of the vehicle complete and was adequate practice in their use provided? [Yes = 20, No = 4, NA = 9]

   Comments: Haven't used all safety features as far as patients are concerned. Haven't had enough training. Reason being: We used a brand new fire extinguisher to put out brake fire and it didn't spray but two inches. No seat belts in back for ambulatory patients. Safety was not stressed enough in class.

10. Was NET on the unique characteristics of the vehicle complete?
    [Yes = 19, No = 5, NA = 9]

Comments: We know nothing concerning the NBC characteristics of the vehicle. Nothing was explained about the NBC capabilities. Should be more air vents in back for adequate ventilation in back of vehicles. They did not have enough information on the heavy variant vehicle.

11. Was NET on the operation of the vehicle on primary roads, secondary roads, and cross-country roads complete and was adequate practice provided? [Yes = 23, No = 1, NA = 9]

Comments: Very much so!

12. Was NET on the operation of the winch and winching procedures complete and was adequate practice provided? [Yes = 2, No = 7, NA = 24]

Comments: No winch. No winch vehicles.

13. Was NET on the vehicle storage locations and their use complete and was adequate practice in loading and unloading equipment and supplies provided? [Yes = 11, No = 8, NA = 14]

Comments: Don't need much practice. Shelters are very difficult to place, as 4 bolts will not hold a shelter on a HMMWV. The final result will be loss of signal men's lives. Was never shown any special storage areas and no adequate practice with loading. Loading ramp not really needed (MNA); takes too long to set up. Instructor didn't know enough on HMMWV ambulance. No load plan.

14. Was NET on the radio and communication equipment complete and was adequate practice in its use provided? [Yes = 4, No = 12, NA = 17]

Comments: No practice. Was never shown radio. No radios in trucks. Hasn't been installed.

15. Was NET on tire changing and run-flat device servicing complete and was adequate practice provided? [Yes = 8, No = 8, NA = 17]

Comments: Call for help. Not authorized to change the tires. Never shown HMMWV test Never changed a tire.

Were the NET handouts and audiovisual aids:

16. Clear? [Yes = 24, No = 2, NA = 7]

Comments: Could have gone into a little more detail.

17. Accurate? [Yes = 19, No = 5, NA = 9]

Comments: Severely outdated.

18. Complete? [Yes = 20, No = 5, NA = 8]

Comments: Did not cover ambulances.

19. Helpful? [Yes = 22, No = 3, NA = 8]

Comments: Maybe.

Was the equipment used during the NET course:

20. Suitable to the objective? [Yes = 19, No = 6, NA = 8]

Comments: Most equipment was more than adequate. Some seems useless: patient loading device. Trucks falling apart.

21. In operating condition? [Yes = 19, No = 5, NA = 9]

22. Available when needed? [Yes = 16, No = 9, NA = 8]

Comments: No help from the motor pool personnel. So-so. Awaiting parts most of the time.

23. Adequately demonstrated? [Yes = 21, No = 5, NA = 7]

Was the training literature, such as the Technical Manual, used during the NET course:

24. Clear? [Yes = 23, No = 5, NA = 5]

25. Accurate? [Yes = 19, NO = 8, NA = 6]

Comments: Maybe. Didn't have the TM change required. Rear brake troubleshooting (Supp. 1).

26. Complete? [Yes = 19, No = 9, NA = 5]

Comments: TM was not complete.

27. Helpful? [Yes = 23, No = 5, NA = 5]

Comments: But should have been put in a cover with non-tearable pages, referring to TM manuals especially. Without it, PMCS would not be possible.

28. Were the NET lessons presented at a good pace (i.e., little time spent waiting for new topics and didn't go too fast)? [Yes = 20, No = 8, NA = 5]

Comments: Time too slow. Went too fast.

29. Were the NET lessons well organized, so that one topic led to another and things were presented in a logical and understandable sequence?
[Yes = 25, No = 3, NA = 5]

30. Was the NET instructor knowledgeable and well informed?
[Yes = 23, No = 4, NA = 6]

Comments: In between. Did not know about HMMWV ambulances. Better than I was.

31. Was the NET instructor clear in the explanations and presentations? [Yes = 26, No = 2, NA = 5]

Comments: Spoke too fast -- too detailed for intro. In between.

32. Overall, was the NET adequate? [Yes = 21, No = 6, NA = 6]

Comments: Yes, but needed more emphasis, preferably on video as to the true importance of the soldier's input. More excitement period in the films and the possibilities and capabilities of the HMMWV, more motivation. On a scale of 1-10, I rate it as a 5. Instructor needs to know about vehicles.

Ambulance Crew

Was the NET adequate for each of the tasks listed below?

33. Loading ambulatory patients? [Yes = 20, No = 4, NA = 9]

Comments: Never showed how.

34. Positioning ambulatory patients? [Yes = 15, No = 8, NA = 10]

Comments: Needs safety restraining devices. Never showed how. What do they hang on to? Bumps.

35. Loading litter patients? [Yes = 17, No = 7, NA = 9]

Comments: Rail too time consuming. Showed 3 or 4 different ways, as if unsure.

36. Positioning litters in the vehicle? [Yes = 20, No = 4, NA = 9]

37. Providing patient care/life support? [Yes = 12, No = 8, NA = 13]

Comments: Didn't go over. No one available. Not yet. You do what you can for them.

38. Using and directing lights (white/blue)? [Yes = 18, No = 5, NA = 10]

39. Unloading patients? [Yes = 18, No = 5, NA = 10]

40. Arranging and attaching medical devices? [Yes = 13, No = 8, NA = 12]

Shelter Crew

Was the NET adequate for each of the tasks listed below:

41. Loading/unloading electronic equipment? [Yes = 5, No = 8, NA = 20]

42. Securing electronic equipment? [Yes = 8, No = 6, NA = 19]

43. Towing the generator? [Yes = 5, No = 9, NA = 19]

44. Operating the generator? [Yes = 5, No = 8, NA = 20]

45. Safe handling of wires/cables? [Yes = 1, No = 10, NA = 22]

46. Antenna preparation and breakdown? [Yes = 5, No = 9, NA = 19]

47. Arranging and using lights? [Yes = 9, No = 5, NA = 19]

Aidman Interview

Sixteen aidmen answered the following interview questions. The distribution of their answers is given for each question.

Entry to and exit from vehicle

13. Are the side doors adequate to enter or exit your assigned position? [Yes = 12, NO = 4, NA = 0]

14. Are the rear doors adequate to enter or exit your assigned position? [Yes = 15, No = 1, NA = 0]

15. Can the steps easily be made ready for use and restowed after use? [Yes = 7, No = 9, NA = 0]

Comments: Safety latch bad. Steps get hung up in litter berth hardware. Steps do not latch in second position easily. Support strap interferes with the release latch. Wheel shut; gap exists at seals. High set. Difficult lift with respect to seat position to enter passenger side. Step latch interferes with upper litter berth support hardware that is attached next to the latch. Steps will not always lock in the second stop. Rear door latch rod does not seat properly in the upper seat location. Attendant must manually push door close to the top to get the rod to seat. Steps come unlatched. Steps are difficult to open. Steps don't close flush, making rear door slightly sprung or difficult to close. Upper litter support straps interfere with step latch.

16. Can ambulatory patients be easily loaded into the compartment? [Yes = 15, No = 1, NA = 0]

17. Can ambulatory patients be easily unloaded from the compartment? [Yes = 16, No = 0, NA = 0]

Can litter patients be easily loaded into the following positions:

18. Upper berth? [Yes = 0, No = 11, NA = 5]

19. Lower berth? [Yes = 4, No = 11, NA = 1]

Comments: Rail should be eliminated. Takes too much time. Cuts finger.

Can litter patients be easily unloaded from the following positions:

20. Upper berth? [Yes = 5, No = 11, NA = 0]

21. Lower berth? [Yes = 0, No = 10, NA = 6]

Comments: Litter racks are a problem; too much trouble. Should use a regular litter and lock them down. Loading rail is too time consuming and cuts hands. Need a system that you can start the litter and then shove it in,

like loading a casket. In combat, you don't have time to fool with the rails. Litters miss ramp rails, ramp does not attach to vehicle securely. Finger gets cut on sharp ramp edges. Ramp not stable, especially on uneven ground. If jolted, ramp comes loose. Litter jumps track, high loads bend rails out, jams litter from wing up. Ramp awkward, difficult to step over center supports. Time to set up long. Do not want rail; do it manually. Ramp is ineffective and difficult to use. It is easy to trip on and has caused several cuts on hands. Ramp is difficult if ground is not level. Ramp would work better if clearance for center cross supports was lower to allow for an easier step while carrying a patient. Not with ramp. No 18 to 20 with rail. Might be able to use a slide ramp. Attach litter to it and shove it all in and lock. Securing ramp difficult. Comes unsecured while loading. Concerned about safety for patient. Attendant can place hands in positions that can cause injury. Suggest loading with both lifts for the litter to be made from the side of the litter. Cannot lift tilted upper berth once loaded, have to have assistance with load bar. Height of upper berth makes loading difficult. Depends upon size of attendant and weight of patient.

Seating

Is the passenger seat adjustment adequate?

22. Up-Down? [Yes = 2, No = 3, NA = 11]

23. Front-Back? [Yes = 2, No = 3, NA = 11]

Comments: No seat adjustment for passenger. No adjustment available. Passenger seat too low. Not adjustable. Has no adjustment available. Short soldiers have a visibility problem due to low seat. Doesn't adjust. Needs more padding.

Was the passenger seat and safety belt adequate for the following traveling conditions:

24. Primary Roads? [Yes = 10, No = 1, NA = 5]

25. Secondary Roads? [Yes = 10, No = 1, NA = 5]

Cross-country:

26. Up-Down Slopes (=> 10%)? [Yes = 8, No = 3, NA = 5]

27. Across Slopes? [Yes = 8, No = 2, NA = 6]

28. Level ground? [Yes = 10, No = 1, NA = 5]

29. Towing a vehicle? [Yes = 1, No = 0, NA = 15]

30. Towing a trailer? [Yes = 1, No = 0, NA = 15]

31. Start-Stop Driving? [Yes = 9, No = 2, NA = 5]

32. Turning at 15 mph or higher? [Yes = 9, No = 1, NA = 6]

33. Traveling more than two HRS? [Yes = 7, No = 3, No = 6]

Comments: Hard on bottom. Needs shoulder restraint. Down-hill and cross-country requires shoulder restraint. Both seats too square with respect to back angle. Comfort poor. Tightening mechanism is difficult. Seat is uncomfortable; poor for long distances. Needs a shoulder restraint.

34. Can the ambulance attendant seat be easily moved into position for use? [Yes = 12, No = 4, NA = 0]

Comments: Edges on runner bar too sharp. Head clearance for patients is too shallow. He has to sit over the wheel well, the worst seating possible. Needs more notches for more positions, especially an up-front position. Will not lock in forward position. Rails diverge toward front, causing seat to fall out. Seat will not lock completely to the front. Uncomfortable seat. If litter patient or ambulatory are present, seat is difficult to bring out from storage.

Was the ambulance attendant seat and seat belt adequate for the following traveling conditions:

35. Primary Roads? [Yes = 9, No = 5, NA = 2]

36. Secondary Roads? [Yes = 8, No = 6, NA = 2]

Cross-country:

37. Up-Down Slopes (=> 10%)? [Yes = 6, No = 8, NA = 2]

38. Across Slopes? [Yes = 6, No = 8, NA = 2]

39. Level ground? [Yes = 7, No = 7, NA = 2]

40. Towing a vehicle? [Yes = 0, No = 1, NA = 15]

41. Towing a trailer? [Yes = 0, No = 1, NA = 15]

42. Start-Stop Driving? [Yes = 6, No = 7, NA = 3]

43. Turning at 15 mph or higher? [Yes = 7, No = 6, NA = 3]

44. Traveling more than two HRS? [Yes = 5, No = 8, NA = 3]

Comments: Have no back protection; will cut tossed all over. No back rest. Seats in the back shouldn't be there. Seat too hard and needs a back rest. Seat was not used after it fell from rails. Cross-country stability in seat poor, rocking back and forth in seat while belted in. Needs a backrest for seat. Too hard, needs more padding. No back support with seat. Keeps you from going forward, but does nothing about backwards. Change seat so you can straddle it to face your patients; seat belt to hold you that way,

especially for CPR and inserting IVs. Seat belt is positioned to prevent forward lunge, but attendant gets thrown backwards. Could use some kind of folding back support. Folds down to top of seat and can fold back when seat is in use. Attendant seat could use more padding and a back support. Must brace yourself. Need some back support. Must also wear helmet because upper berth racks are not padded, making some medical tasks difficult. Uncomfortable for long distances.

Can the patient seating/litter racks be easily interchanged in the following ways:

45. 4 litter to 2 litter & 4 ambulatory? [Yes = 16, No = 0, NA = 0]

46. 8 ambulatory to 2 litter & 4 ambulatory? [Yes = 15, No = 0, NA = 1]

Comments: All changed easily. Seat hardware would not work at times. Not enough storage in vehicle. Need different locks to keep seats up. Maxi- has no padding for ambulatory patients. When upper berth comes down, it should go all the way to the wall or bring upper straight down and stack on bottom. Would give you head clearance to work on patients and CPR. End latches have gotten sloppy.

Was ambulatory patient seating and restraint adequate for the following traveling conditions:

47. Primary Roads? [Yes = 7, No = 9, NA = 0]

48. Secondary Roads? [Yes = 4, No = 12, NA = 0]

Cross-country:

49. Up-Down Slopes (=> 30%)? [Yes = 2, No = 14, NA = 0]

50. Across Slopes? [Yes = 2, No = 14, NA = 0]

51. Level ground? [Yes = 3, No = 13, NA = 0]

52. Towing a vehicle? [Yes = 0, No = 2, NA = 14]

53. Towing a trailer? [Yes = 0, No = 2, NA = 14]

54. Start-Stop Driving? [Yes = 6, No = 10, NA = 0]

55. Turning at 15 mph or higher? [Yes = 4, No = 12, NA = 0]

56. Traveling more than two HRS? [Yes = 3, No = 13, NA = 0]

Comments: No way to restrain an ambulatory patient. Need restraints. No padding for patients; needs seat belts. Back angle poor. Need handholds and padding. Back angle awkward, too far back. No padding makes seating uncomfortable. No restraints available so patients are knocked about. Seats small for ambulatory, patients hit their heads during cross-country travel.

Patients uncomfortable over long travel times. Need seat belts. Tall person has difficulty sitting as an ambulatory patient. No restraints. If attendant is in the seat, can't get between the ambulatory patients - legs get in the way. Seats uncomfortable and no restraints. Needs seating restraints; seats too small, strap tore out of ceiling. Patients moving around, not restrained during cross-country; nothing to grab on to. Need padding and seat restraints. Padding should be vinyl. No padding for ambulatory seating. Need handhold straps in maxi-ambulance.

Were the litter racks and patient restraints adequate for the following traveling conditions:

57. Primary Roads? [Yes = 13, No = 3, NA = 0]

58. Secondary Roads? [Yes = 12, No = 4, NA = 0]

Cross-country:

59. Up-Down Slopes (=> 30%)? [Yes = 9, No = 7, NA = 0]

60. Across Slopes? [Yes = 9, No = 7, NA = 0]

61. Level ground? [Yes = 9, No = 7, NA = 0]

62. Towing a vehicle? [Yes = 2, No = 0, NA = 14]

63. Towing a trailer? [Yes = 2, No = 0, NA = 14]

64. Start-Stop Driving? [Yes = 10, No = 6, NA = 0]

65. Turning at 15 mph or higher? [Yes = 12, No = 4, NA = 0]

66. Traveling more than two HRS? [Yes = 12, No = 4, NA = 0]

Comments: Hard bump and rough terrain -- they'd pop loose. Need a positive restraining system. Straps get tangled in litter when unloading. Litter hold straps do not conform to the litter handles. Suggest a circular clamp that litter ends fit into at forward end of litter. Need to be tightened enough -- they'd be alright. Don't hold -- pop open. Yes, if they had the litter down. No, keep popping open. Put the down strap in front in the back. Back needs pad for patient's head during vehicle panic stop. Litter restraining straps pop off rear litter. Restraint allows litter to slide out. Patient's body (posterior) can contact bottom of litter berth. Litters not steady enough. Litters will slide front to back. Long travel is comfortable only on primary roads.

Communications inside vehicle, and radio

Was the communication between the driver and passenger adequate under the following conditions:

67. When parked - engine idling? [Yes = 13, No = 1, NA = 2]

When driving:

68. Primary Roads at over 25 mph? [Yes = 11, No = 3, NA = 2]

69. Secondary Roads? [Yes = 11, No = 3, NA = 2]

70. Cross-country? [Yes = 10, No = 4, NA = 2]

Comments: Too noisy. When highway driving, you have to shout to passengers. Yes, but had to speak loudly. Communications for driver and attendant in back poor without intercom. Too much noise due to engine fan. Difficult to talk when fan kicks on.

Was the communication between the aidman and patients adequate under the following conditions:

71. When parked - engine idling? [Yes = 15, No = 1, NA = 0]

When driving:

72. Primary Roads at over 25 mph? [Yes = 14, No = 2, NA = 0]

73. Secondary Roads? [Yes = 13, No = 3, NA = 0]

74. Cross-country? [Yes = 12, No = 4, NA = 0]

75. When using the intercom? [Yes = 3, No = 0, NA = 13]

Comments: Patients must speak very loud to be heard. During cross-country travel, communication is difficult due to aidman not able to leave seated position. Difficult from equipment rattling noise in back compartment. Noise from debris hitting under vehicle.

Was the volume/clarity of radio message adequate with the vehicle:

Parked:

76. Engine off? [Yes = 11, No = 1, NA = 4]

77. Engine idling? [Yes = 10, No = 2, NA = 4]

Driving:

78. Primary Roads at over 25 mph? [Yes = 10, No = 2, NA = 4]

79. Secondary Roads? [Yes = 10, No = 2, NA = 4]

80. Cross-country? [Yes = 9, No = 2, NA = 5]

Comments: Particular radio set sounds garbled.

Was it easy for the passenger to reach and operate the radio controls:

81. When parked? [Yes = 8, No = 1, NA = 7]

When driving:

82. Primary Roads? [Yes = 9, No = 1, NA = 6]

83. Secondary Roads? [Yes = 9, No = 1, NA = 6]

84. Cross-country? [Yes = 7, No = 2, NA = 7]

Comments: Had portable. Walkie-talkie. Too rough to manipulate during cross-country travel. Angle to see radio poor. Passenger has to loosen seat belt to adjust radio.

Was the ambulance compartment communication with the driver adequate when using the intercom:

85. When parked - engine idling? [Yes = 1, No = 0, NA = 15]

When driving:

86. Primary Roads? [Yes = 1, No = 0, NA = 15]

87. Secondary Roads? [Yes = 1, No = 0, NA = 15]

88. Cross-country? [Yes = 1, No = 0, NA = 15]

Comments: Didn't have intercom. No intercom. No intercom available at this time.

Ventilation

Was the air conditioning/ventilation in the ambulance compartment (air flow) adequate for cooling/heating under the following conditions:

Windows/vents open:

89. Vehicle standing? [Yes = 9, No = 7, NA = 0]

Comments: Fumes made everyone sick.

90. Vehicle moving? [Yes = 7, No = 9, NA = 0]

Windows/vents closed:

91. Vehicle standing? [Yes = 8, No = 8, NA = 0]

92. Vehicle moving? [Yes = 5, No = 11, NA = 0]

Comments: Too much dust. Engine heat in cab excessive. No cooling for driver. Air conditioning did not function properly; recommended maintenance

at PMCS. Bit hot. Air conditioner is difficult to switch on while traveling cross-country. Standing to get at controls very difficult. Dust from windows and from the back door if latches were ajar. Need more than one air vent. Yes, if not it's stuffy. No cross ventilation in back. Not enough air movement. Splint set, aid bag in stow position blocks clear air flow for rear vent. Need air conditioning. Must filter more dust. Too much dust coming in from vents.

Was the air conditioning/ventilation system adequate for eliminating dust and fumes in the ambulance compartment under the following conditions:

Windows/vents open:

93. Vehicle standing? [Yes = 12, No = 4, NA = 0]

94. Vehicle moving? [Yes = 10, No = 6, NA = 0]

95. Secondary roads & cross-country? [Yes = 4, No = 12, NA = 0]

Windows/vents closed:

96. Vehicle standing? [Yes = 12, No = 3, NA = 1]

97. Vehicle moving? [Yes = 11, No = 4, NA = 1]

98. Secondary roads & cross-country? [Yes = 7, No = 8, NA = 1]

Comments: Dust from windows a problem when fan is turned on; settled dust is churned up. Windows always open due to lack of air conditioning. Dust was a problem from vent. Dust entry through vents and back door step seals. Dust also a problem due to driver always keeping the window open to stay cool since air conditioner doesn't reach him. Air conditioning system noisy -- hums. Depends on road. Dust comes in through gaskets at steps and where doors come together. Especially as doors shift during cross-country travel. Dust must be filtered to eliminate the contamination possible to patient wounds. Dust is getting into sealed up vehicle. Dust is getting past door seals.

Noise

Were the noise levels in the ambulance compartment acceptable (low) under the following conditions:

Windows/vents open:

99. During warm-up? [Yes = 12, No = 4, NA = 0]

100. Primary roads at over 25 mph? [Yes = 12, No = 4, NA = 0]

101. Secondary roads & cross-country? [Yes = 10, No = 6, NA = 0]

Windows/vents closed:

102. During warm-up? [Yes = 13, No = 3, NA = 0]

103. Primary roads at over 25 mph? [Yes = 13, No = 3, NA = 0]

104. Secondary roads & cross-country? [Yes = 9, No = 7, NA = 0]

Comments: Upper litters clang. Light cords make noise. Light cords and litter racks are noisy. Too much metal on metal contact. Items in rear of ambulance, litters in up position, light cords make a great amount of noise. Back of vehicle noise makes communication difficult.

Working Space

Is the attendant's station in the ambulance adequate in terms of the following:

105. Overall space for attendant? [Yes = 10, No = 6, NA = 0]

106. Arm/elbow room for treating patients? [Yes = 10, No = 5, NA = 1]

107. Leg/knee room for attendant? [Yes = 10, No = 4, NA = 2]

108. Headroom for standing attendant? [Yes = 6, No = 8, NA = 2]

Comments: Work station cluttered if you had a mix of ambs and litters. Attendant cannot perform CPR. Cannot reach patients while belted in attendant seat. CPR difficult on cross-country if upper litter berth is used. While working on a patient in the upper berth, the attendant can't restrain himself. If you are working on patients, there isn't room. CPR hard to administer on IV - almost impossible to do. Space between patients not adequate for attending or performing CPR. Head room tight when working on patients. Cramped when loaded with ambulatory. Poor leg space. Ambulatory patients have to crouch due to lack of head room. Head room alright for attendant. Must stoop while standing.

Is the stowage space and the accessibility of the medical items adequate under the following conditions:

Use outside ambulance:

109. Aid bag? [Yes = 15, No = 1, NA = 0]

110. Air bag? [Yes = 5, No = 0, NA = 11]

111. Intravenous solutions? [Yes = 13, No = 1, NA = 2]

112. Oxygen? [Yes = 3, No = 4, NA = 9]

113. Pressure cuff & stethoscope? [Yes = 9, No = 1, NA = 6]

114. Vital Signs Monitor? [Yes = 1, No = 1, NA = 14]

Use inside the ambulance:

115. Aid bag? [Yes = 12, No = 4, NA = 0]

116. Air bag? [Yes = 4, No = 0, NA = 12]

117. Intravenous solutions? [Yes = 11, No = 4, NA = 1

118. Oxygen? [Yes = 3, No = 4, NA = 9]

119. Pressure cuff & stethoscope? [Yes = 10, No = 0, NA = 6]

120. Vital Signs Monitor? [Yes = 3, No = 0, NA = 13]

Comments: Oxygen bottle strap comes over the neck. Have to take top off to hook up oxygen so the bottle will fly around. Aid bag interferes with free movement if open in aisle. IV bag storage not easily accessible. Yes, but cramped with aid bag. No way to stow aid bag. Only room for splints in passenger side bottom berth. Oxygen bottles not in use. Oxygen bottle inside. No way to put a regulator on it so you can't administer oxygen en route. Oxygen is located behind the patients and you have to reach over them. Storage is too limited. Need more pockets for personal gear. IV stowage tough to get to. Need more storage shelves above litter patients.

Visibility

Is the passenger's visibility adequate through the following:

121. Windshield? [Yes = 11, No = 2, NA = 3]

122. Side windows? [Yes = 12, No = 1, NA = 3]

Comments: Blind spot due to windshield posts. Seat too low. Blind spot exists at edges of windshield.

Is the passenger's view unobstructed when driving:

123. Forward? [Yes = 12, No = 1, NA = 3]

124. Backward? [Yes = 11, No = 2, NA = 3]

Comments: Must use mirror which is poor or hang outside window. Using mirror only for back up.

Is the visibility around the ambulance adequate for triage, etc. during night operations with:

125. Exterior lights? [Yes = 1, No = 0, NA = 15]

126. Blackout conditions? [Yes = 0, No = 1, NA = 15]

Comments: Haven't driven at night.

Can the attendant easily see the patients under the following conditions:

Daylight:

127. Upper litter patients? [Yes = 10, No = 0, NA = 6]

128. Lower litter patients? [Yes = 12, No = 4, NA = 0]

129. Seated ambulatory patients? [Yes = 15, No = 1, NA = 0]

Night time - Blue Lights:

130. Upper litter patients? [Yes = 2, No = 1, NA = 13]

131. Lower litter patients? [Yes = 1, No = 4, NA = 11]

132. Seated ambulatory patients? [Yes = 2, No = 3, NA = 11]

Night time - White Lights:

133. Upper litter patients? [Yes = 3, No = 0, NA = 13]

134. Lower litter patients? [Yes = 4, No = 1, NA = 11]

135. Seated ambulatory patients? [Yes = 5, No = 0, NA = 11]

Comments: Need light socket positions for moveable lighting for lower litter patients. Even during daylight, you need white light to see patients.

Can the attendant easily add light for seeing patients:

136. Blue lights? [Yes = 4, No = 5, NA = 7]

137. White lights? [Yes = 15, No = 1, NA = 0]

Comments: Hard to light bottom litter patient. Just white lights.

Usability of controls and displays

Can the passenger easily reach and operate the following controls:

138. Ignition/starter control? [Yes = 2, No = 11, NA = 3]

139. Lights? [Yes = 2, No = 11, NA = 3]

140. Windshield wiper? [Yes = 10, No = 3, NA = 3]

141. Parking brake? [Yes = 4, No = 9, NA = 3]

142. Heater/ventilation cab? [Yes = 2, No = 10, NA = 4]

143. Heater/ventilation amb. comp.? [Yes = 4, No = 9, NA = 3]

144. Intercom controls? [Yes = 3, No = 2, NA = 11]

145. Radio controls? [Yes = 8, No = 1, NA = 7]

Comments: Radio is a difficult angle for passenger. Other controls are hard to reach over radio. Radio blocks lights, parking brake, ignition, heater/vent controls for passenger. Many controls are difficult to reach.

Are the following items easily accessible and usable?

146. Fire extinguisher when outside? [Yes = 11, No = 3, NA = 2]

147. Fire extinguisher when in ambulance compartment? [Yes = 8, No = 7, NA = 1

148. Fire extinguisher when in passenger seat? [Yes = 9, No = 4, NA = 3]

149. Pioneer tools when outside? [Yes = 15, No = 1, NA = 0]

Comments: Supposed to be bolted at passenger seat. Must enter through passenger side and strain to get to the extinguisher. Need an extinguisher for rear compartment. Pioneer tools are difficult to get out.

Are the following displays readable and understandable:

Passenger seat:

150. Ventilation system indicators? [Yes = 3, No = 7, NA = 6]

151. Cooling/heating indicators? [Yes = 3, No = 9, NA = 4]

152. Radio indicators? [Yes = 8, No = 1, NA = 7]

153. Intercom indicators? [Yes = 3, No = 2, NA = 11]

154. Lighting indicators? [Yes = 6, No = 6, NA = 4]

Attendant seat (white light or daylight):

155. Ventilation system indicators? [Yes = 11, No = 4, NA = 1]

156. Cooling/heating indicators? [Yes = 14, No = 2, NA = 0]

157. Radio indicators? [Yes = 10, No = 1, NA = 5]

158. Intercom indicators? [Yes = 4, No = 1, NA = 11]

159. Lighting indicators? [Yes = 12, No = 3, NA = 1]

160. Oxygen status? [Yes = 4, No = 1, NA = 11]

161. Vital signs monitor? [Yes = 1, No = 1, NA = 14]

Attendant seat (blue light or night light):

162. Ventilation system indicators? [Yes = 0, No = 2, NA = 14]

163. Cooling/heating indicators? [Yes = 0, No = 2, NA = 14]

164. Radio indicators? [Yes = 2, No = 0, NA = 14]

165. Intercom indicators? [Yes = 0, No = 2, NA = 14]

166. Lighting indicators? [Yes = 0, No = ? NA = 14]

167. Oxygen status? [Yes = 0, No = 2, NA = 14]

168. Vital signs monitor? [Yes = 0, No = 1, NA = 15]

Comments: Radio blocks seeing the vent controls. Cannot see the light switches.

Aidman Checklist

Seventeen aidmen answered the checklist questions, one more than was interviewed.

21. Were there any problems during the PMCS (procedures, documentation, etc.) before this mission/scenario? If YES explain.
[Yes = 6, No = 11, NA = 0]

Comments: During the PMCS, it states that the transmission must be at normal operating temperature. Then in the next step you check the cooling system. These two steps should be switched. Also, the service brake, transmission, and transfer case should all be before those steps because it's necessary to shift transmission before checking fluid. Horn should be checked with service lights #15. Instruments should be observed immediately after starting engine #16. Stairs system locks sometimes. There are some things that deadline the vehicle by the TM that are unnecessary, i.e., oxygen, IV straps. The vehicles are parked too close together. Manuals (TM) falling apart. At times, there may be additional maintenance that needs to be done which may be more than 30 minutes. The manual says that the transmission is to be at normal operating temperature. The next step is to check the cooling system. These two steps should be switched.

22. Were there any problems with the doors, steps, or the loading/unloading of patients during this mission/scenario? If YES explain.
[Yes = 14, No = 3, NA = 0]

Comments: Yes, the loading ramp pinches your hands while setting the litter on it and sliding it up. Racks are clumsy and too time consuming. Doors of rear compartment are difficult to close. The steps seem to stick when you push the lever and the back doors have a tendency to miss the top hole when trying to close the door. Rear steps often become difficult to open. Rear doors often opened up while on missions. Rails too time consuming - one big hassle. Doors don't always fasten easily; they also come open once in a while. Just the steps and the loading ramps. Step sticks - gaps around step. Doors pop open; steps don't want to open. Door latch partially inoperable. Took two hands to work latch. Steps generally bulky, awkward - don't always lock in upmost position. Step latch does not fully engage sometimes. Too much time taken out to do little things that aren't essential. Example: All the latches for the steps, the ramps take too long to put into operation and put away. You pinch your hands on the loading ramp when loading.

23. Were there any problems loading, storing, accessing, or unloading any of the equipment during this mission/scenario? If YES explain.
[Yes = 10, No = 7, NA = 0]

Comments: The aid bags should be held up by nets instead of straps in the mini (M996) so it would be possible to open the top of the black rubberized aid bag without taking it all down to get to your equipment. Equipment gets hooked on securing straps - makes it difficult to load/off load. It becomes monotonous putting tools underneath vehicle daily. Takes too long to set up loading ramp, litters jump off loading ramp. Traction splint and blanket set bulky - cover fuse box and vision of equipment operating apparatus. Latches

catch on litter. Many problems accessing equipment, i.e., wet bag, blanket set. Especially medical supplies - way too much time to get emergency equipment. Suggestion: Side compartments on slim line overhead units for cravats, stethoscope, ointments, shots, etc. Larger storage compartments are needed. Rivets mission on (R) side - medical bag. Litter rack has to go. Too much of the litter's items to worry about. When loading, you pinch your hands on the loading ramp.

24. Were there any problems with the passenger seat during this mission scenario? If YES explain. [Yes = 8, No = 7, NA = 2]

Comments: Not enough leg room. After a hour or two with your feet together that close, it gets extremely uncomfortable. Passenger claims that the front metal part of the seating is a bit uncomfortable. Very uncomfortable. Data collector rides in passenger seat. The attendant's seat needs back support. Needs more padding, too low, needs adjustments, shoulder belts. Door handles stick in your back. Doesn't feel secure enough, bruises legs easily. It is uncomfortable for the passenger - it should be padded.

25. Were there any noise problems during this mission/scenario? If YES explain. [Yes = 11, No = 4, NA = 2]

Comments: Slightly hard to keep good communication between crewmembers. Difficult to communicate with driver. Engine noise, litter racks rattle. When fan or heater is running with engine on. Not really. Rattling and squeaking of equipment in back - very irritating. Backs of vehicles are very noisy, making it difficult to hear other personnel. Everything, I mean everything, rattles. The hood, the roof, the door, equipment - front and back; the IV bag holders, the light cords, helicopter insulation covering entire patient area, and roof area of driver's cab. Less straps, more exact size compartment securing area -take the needed equipment and design compartment. The air bag, (black) bag keeps falling off side walls. Cords and straps smacking the wall are very noisy. Excess rattling - engine noise made it impossible to talk to front personnel. You have to talk extra loud for the other person/people to hear you. It is hard to hear a blood pressure.

26. Were there any problems with crew or patient communication (v rbal or visual) during this mission/scenario? If YES explain.
[Yes = 1, No = 12, NA = 4]

Comments: Difficult to communicate with driver. Engine noise/litter racks rattle. If you leave the door open (door from litters compartment and two front), crewmembers and patients have problems with hearing each other. Need to have data collector repeat himself on occasions. It's so loud, one must scream to hear. Ventilation is no good. The A/C doesn't work - too much dust in back. As stated in previous question. Hard to hear driver while in back - too much rattling. Noise too great to hear other personnel. Driver cannot talk cab to patient area without screaming. Driver cannot talk to passenger without raising voice loudly.

27. Were there any problems with radio communication during this mission? If YES explain. [Yes = 17, No = 0, NA = 0]

Comments: Radio in vehicle is missing microphone.

28. Were there any problems with the ventilation system for heating/cooling and/or fumes/dust during this scenario? If YES explain.
[Yes = 13, No = 3, NA = 1]

Comments: Needs more dust filter. The ventilation system needs more filterization. Too much dust is allowed in through vents - need a filter. Very dusty. Mini-ambulances are hot boxes. Fan is insufficient. Dust is major problem. Accumulates very quickly, even with doors closed. Dust!!! Stuffy in the patient compartment, even when fan is on high, and there are a lot of spots where light can be seen from the inside when lights are off, allowing dust to be able to come in. No ventilation in back of the vehicle - nausea, all week. Heating system produces nauseating fumes and cooling system blows in. Not adequate coding in mini-ambulance. Weak, weak, weak fan unit and weaker filter device. Kicks mouthfuls of dust through system with or without it. A lot of dust seeping in through crack in stairwell and vent not putting enough cool air. Dust everywhere. Fan doesn't work. Eat dust all day. The ambulance gets extremely hot in the patient compartment - no air at all goes through. Also, too much dust comes through all the cracks and places where seals aren't tight enough. Both of these items make it very hard to breathe and I'm sure wouldn't be suitable for patients. When the ventilation system is turned on after riding through dusty trails, it blows in dust.

29. Were there any problems with the ambulance attendant working space during this scenario? If YES explain. [Yes = 14, No = 1, NA = 2]

Comments: Not enough room to do CPR - cannot stand without stooping. You have very little room to move. Need more room. Not enough room with litter and ambulatory combined. When there were 2 litters and 4 ambulatory, there was no room. Very difficult to perform CPR. Very cramped with both ambulatory patients and litter patients. Need more space. Can't reach control switches. Not enough sliding stop points on seat adjustment. Can't reach medical equipment, supplies. The space is very limited. Too small. Unable to do CPR. Not enough room to move around.

30. Were there any problems seeing the patients from the passenger position or seeing the patients while outside or inside during this mission? If YES explain. [Yes = 8, No = 9, NA = 0]

Comments: You can't see them. Back needs more lighting. Bouncing all over place - seats too small. Not enough back support, no restraints/litter - a joke. Yes, this is relevant - can't see them if they are bouncing all over the place. No window. Have to move a lot to see the patients from passenger seat.

31. Were there any problems reaching/using any of the accessory equipment controls (heater, radio, etc.) or emergency equipment (fire extinguisher, pioneer tools) during this mission/scenario? If YES explain.
[Yes = 5, No = 12, NA = 0]

Comments: Blankets should be stowed on left side of ambulance under NBC attachments. Gets in the way of heater vents and operation, especially with driver compartment doors open. If you needed to get equipment, the roads are too rough to get up (CPR is impossible). Ambulatory patients had no restraints (also attendant). Have to reach over patient to get all equipment.

32. Were there any hazardous or unsafe conditions during this mission scenario? If YES explain. [Yes = 12, No = 5, NA = 0]

Comments: Rough roads. No matter how slow you go, bumps are bumps. Ambulatory patients had no restraints (also attendant). The back of the ambulance is hazardous to itself. Riding in the back of the ambulance, period. Redo everything with medics, paramedics and 91A10 OTEA field as in Yakima. Medics at the drawing table. This is not a joke. Being thrown around in the back of a vehicle is very unsafe.

33. Were there any problems with the vehicle lighting during this mission scenario? If YES explain. [Yes = 13, No = 4, NA = 0]

Comments: Not bright enough. Lights would flicker on and off when on trails because of rear doors not being shut tight. Inadequate lighting during B/O operation. Need 2 blackout lights in rear of patient compartment area. Blackout inoperative.

34. Were there any problems with the ambulance attendant seat during this mission? If YES explain. [Yes = 3, No = 12, NA = 2]

Comments: Unpadded litter racks with no helmet is hazardous to attendant. Very uncomfortable - needs back support. No back support and not very stable. No back support. Inadequate seat belts. Unsafe, needs tall back to it and a lot more cushioning. It gets in the way of the ambulatory legs. Did not use it. Don't lean backwards or else you fall off. It is very uncomfortable after sitting there for a long period of time. It should be padded more and a back support should be added to the seat.

35. Were there any problems with the patient seats or litters during this mission scenario? If YES explain. [Yes = 0, No = 0 , NA = 17]

Comments: Litter patients get thrown around because they have no control. Not tall enough for back, nor long enough for buttocks. Litter bouncing loose, no cushioning on either; especially litters. Suggestion: Larger seats, deeper seats to keep patient still as possible -- maybe bucket style padding. Deep slide out trays with washable padding which contours to the weight of the patient and wider padded straps to hold patient. Litters don't stay strapped down. The patient seats are uncomfortable. They should be padded.

36. Were there any problems with equipment or stowed supplies during this mission scenario? If YES explain. [Yes = 0, No = 0, NA = 17

Comments: As said before, aid bags cannot be used without unstrapping and taking them off the wall (only in mini-ambulances). Therefore, they should be stored in a net-type carrier so the tops could be opened.

Driver Interview

Interview data was obtained from 24 drivers.

Entry

13. Are the side doors adequate to enter or exit your assigned position? [Yes = 17, No = 7, NA = 0]

Comments: Swing out - knee hits light fixture.

14. Are the rear doors adequate to enter or exit your assigned position? [Yes = 19, No = 2, NA = 3]

15. Are the steps easily made ready for use and restowed after use? [Yes = 12, No = 8, NA = 4]

Comments: Latch - strap from upper berth gets in way of thumb latch. Safety latch gets hung up. Do not lock, second position click, steps get hung up on litter berth hardware. Safety latch time consuming. Gasket seal is poor around steps. Little bit too high to step down. Complicated to set up and stow steps. Hit knee on window frame. Ankle catches on well on exit. Doors keep popping open. Steps keep coming unlocked - even when locked, they can be bounced open. Radio blocks entry to the driver's position when entering from the back. Handholds above attendant door would be helpful. Latch difficult. Large gap between tailgate and vehicle bed. Tripping hazard. Knee hits side panel upon entry. Door must be lifted to ensure closure. Plastic door handles flimsy. Steps are difficult to use. Difficult to lift leg over door sill or exit vehicle in fast order.

Seating

Is the driver's seat adjustment adequate:

16. Up-Down? [Yes = 16, No = 8, NA = 0]

17. Front-Back? [Yes = 12, No = 12, NA = 0]

Comments: In up position, seat is too forward. Awkward to adjust, must get out of vehicle. Gets stuck and difficult to lift. Tighten up and down. Not enough seat positi , for front-back adjustment. Seat does not move far enough back. Does not adjust to a comfortable/optimum position. Needs to go back more. Adjustment too limited. Higher adjustment moves legs too close to wheel and peddles. Not enough leg room, too low to see to the left. Difficult to adjust. Do not like adjustment procedure, should roll front to back. Must put extra padding. Use a pillow for seat comfort. Knee hits throttle control knob.

Was the driver's seat and safety belt adequate under the following traveling conditions:

18. Primary Roads? [Yes = 21, No = 2, NA = 1]

19. Secondary Roads? [Yes = 20, No = 3, NA = 1]

Cross-Country:

20. Up-Down Slope (=> 6%)? [Yes = 17, No = 6, NA = 1]

21. Across Slopes? [Yes = 17, No = 6, NA = 1]

22. Level Ground? [Yes = 18, No = 5, NA = 1]

23. Towing a vehicle? [Yes = 0, No = 0, NA = 24]

24. Towing a trailer? [Yes = 1, No = 2, NA = 21]

25. Start-Stop Driving? [Yes = 19, No = 4, NA = 1]

26. Turning @ 15 mph or higher? [Yes = 20, No = 3, NA = 1]

27. Traveling more than two hours? [Yes = 9, No = 13, NA = 2]

Comments: Seat too hard. Need shoulder harness, more padding. Sits too far upright. Legs get cramped. Could use a shoulder strap. Seat too hard. Needs better cushioning, too far forward. Needs more padding. Uncomfortable for extended periods. Uncomfortable for long traveling times. Seat too hard, needs more padding. Uncomfortable, no side to side restraint. Not traveled any long distances yet. Seat back is too upright, not enough padding. Not adequate shoulder restraint, more padding, hurts driver's back. No experience. Needs shoulder restraint, needs more padding similar to gamma goat. Shoulder restraint is requested. Pillow is added to improve back support. Needs more padding. Have used gamma goat seat cushions for extra padding.

Communications inside vehicle, and radio.

Was the communication between the crewmembers adequate under the following conditions:

When parked:

28. Engine off? [Yes = 22, No = 0, NA = 2]

29. Engine idling? [Yes = 18, No = 4, NA = 2]

Comments: Couldn't hear -- someone in back, you can't hear. Talk loud.

When driving:

30. Primary Roads @ > 25 mph? [Yes = 12, No = 9, NA = 3]

Comments: Couldn't hear - someone in back, you can't hear. Talk loud.

31. Secondary Roads? [Yes = 12, No = 10, NA = 2]

Comments: Couldn't hear - someone in back, you can't hear. Talk loud.

32. Cross-country? [Yes = 10, No = 12, NA = 2]

33. When using the intercom? [Yes = 1, No = 1, NA = 22]

Comments: Haven't tried it - haven't got speaker for it. Didn't have an intercom. Too much noise, especially with fan running. Tough to hear due to all the back of ambulance noise. No intercom. Intercom didn't work. Too noisy for communication to back. Is adequate for driver to passenger. If attendant in rear, it's hard to hear. Intercom didn't work. Intercom doesn't work. At high rpm - up hills - can't hear. Too noisy. Request some noise proofing from engine, tire noise. When fan comes on, driver cannot hear attendant unless attendant comes up through bulkhead door. Engine fan with combination of vehicle rattling noise makes communication difficult.

Was the volume/clarity of radio messages adequate with the vehicle:

Parked:

34. Engine off? [Yes = 11, No = 1, NA = 12]

35. Engine idling? [Yes = 11, No = 1, NA = 12]

Driving:

36. Primary Roads @ > 25 mph? [Yes = 10, No = 2, NA = 12]

37. Secondary Roads? [Yes = 10, No = 2, NA = 12]

38. Cross-country? [Yes = 9, No = 3, NA = 12]

Comments: Had walkie-talkie. No radio installed. Needed many repeat radio messages during cross-country travel. Radio seemed more garbled. Radio set seems garbled, possibly a problem with the antenna. No experience - passenger with handheld seemed to have trouble. Walking - talking - too noisy on move.

Were the radio controls easy to operate:

39. When parked? [Yes = 10, No = 1, NA = 13]

When driving:

40. Primary Roads? [Yes = 8, No = 3, NA = 13]

Comments: Had to take eyes off road.

41. Secondary Roads? [Yes = 8, No = 3, NA = 13]

Comments: Had to take eyes off road.

42. Cross-country? [Yes = 7, No = 4, NA = 13]

Comments: Had to take eyes off road. Had walkie-talkie — driving a marine comp. vehicle. Too rough to operate, bump arm. Mike is on other side of radio. Poor angle to control radio from driver's position.

Was the ambulance compartment communication adequate when using the intercom:

43. When parked - engine idling? [Yes = 0, No = 0, NA = 24]

When driving:

44. Primary Roads? [Yes = 0, No = 0, NA = 24]

45. Secondary Roads? [Yes = 0, No = 0, NA = 24]

46. Cross-country? [Yes = 0, No = 0, NA = 24]

Comments: No intercom. Didn't try it. Intercom didn't work - no instructions on its use.

Ventilation

Was the cooling/heating adequate under the following conditions:

Windows/vents open:

47. Vehicle standing? [Yes = 17, No = 6, NA = 1]

48. Vehicle moving? [Yes = 14, No = 9, NA = 1]

Comments: Too much dust -- even with windows closed and fan on it sucks dust.

Windows/vents closed:

49. Vehicle standing? [Yes = 11, No = 12, NA = 1]

50. Vehicle moving? [Yes = 7, No = 16, NA = 1]

Comments: No air conditioning for driver. Heat from engine cow. Air coming in vents too hot; air doesn't come in side windows. Heater provided entry for gas fumes. Air conditioning - air not cooled. Too dusty and air conditioning doesn't get to driver. No air conditioning. Generally yes - depending upon how hot it gets. Engine blows hot air regardless of exterior air entry. Too hot with the windows up. Poor for hot climate. Too much engine heat from side. Note: Driver fatigue sooner due to lack of air flow. Too much dust.

Was the ventilation system adequate for eliminating dust and fumes under the following conditions?

Windows/vents open:

51. Vehicle standing? [Yes = 14, No = 8, NA = 2]

Comments: No -- in the back. Cab -- okay.

52. Vehicle on primary roads? [Yes = 16, No = 7, NA = 1]

53. Secondary roads & cross-country? [Yes = 7, No = 16, NA = 1]

Windows/vents closed:

54. Vehicle standing? [Yes = 19, No = 4, NA = 1]

55. Vehicle on primary roads? [Yes = 19, No = 4, NA = 1]

56. Secondary roads & cross-country? [Yes = 12, No = 11, NA = 1]

Comments: Too much dust. Dust came in during cross-country through windows. No improvement due to lack of air flow and cross ventilation. With vents open, dust comes in. Too much dust gets in.

Noise

Were the noise levels acceptable (low) under the following conditions:

Windows/vents open:

57. During warm-up? [Yes = 21, No = 1, NA = 2]

Comments: Lot of noise from stuff in back. Antenna hitting road. Litter racks. All other fixtures just hang.

58. Primary roads @ >25 mph? [Yes = 16, No = 5, NA = 3]

59. Secondary roads & cross-country? [Yes = 13, No = 9, NA = 2]

Windows/vents closed:

60. During warm-up? [Yes = 21, No = 1, NA = 2]

61. Primary roads @ >25 mph? [Yes = 18, No = 3, NA = 3]

62. Secondary roads & cross-country? [Yes = 14, No = 8, NA = 2]

Comments: Noise generated by back of ambulance. Too much noise generated by litter berths and loose items in back. One time it bothers is when it overheats and fan kicks on. Difficult with engine fan on. Cab canvas of back flaps - noise is load. Noise from soft top flapping around is excessive, especially behind driver's head. Excessive engine noise, plastic soft top back flaps creating more noise. Engine fan creates too much noise to talk over.

Working space

Is your station in the vehicle adequate for performing your job in terms of the following:

63. Overall space for driver? [Yes = 18, No = 6, NA = 0]

64. Arm and elbow room? [Yes = 18, No = 6, NA = 0]

65. Leg and knee room? [Yes = 9, No = 14, NA = 1]

Comments: Need more room for RT 2 KG. Engine wall too close to hand brake.

66. Headroom? [Yes = 23, No = 0, NA = 1]

Comments: Need more room for taller driver. No place to rest arms, legs cramped and knees hit under dash. Knee hits window frame. Knees cramped. Too close. Knee is too hot against engine cowl, bumps throttle lock, window guides. Legs were cramped, knees hit dash. Need left arm elbow rest. Needs arm rest. Legs cramped. More seat padding. Leg room is limited. Cramped. Need left arm rest, engine cowl and dash coating cause skin abrasions. Accelerator is at a bad angle. Large gap between brake and gas pedal. Knee hits throttle control. Metal below seat hits back of calf muscle.

Visibility

Is the driver's visibility adequate through the following:

67. Windshield? [Yes = 16, No = 7, NA = 1]

Comments: Not passenger windshield. Can't see right corner of vehicle.

68. Side windows? [Yes = 11, No = 11, NA = 2]

Comments: On turns, it's hard to see.

69. Rear view mirrors (driving)? [Yes = 5, No = 15, NA = 4]

Comments: Mirrors vibrate. Don't hold a position.

70. Rear view mirrors (backing)? [Yes = 6, No = 13, NA = 5]

Comments: Mirrors are generally inadequate. Need to be replaced. Need to be bigger to hold a steady position. Need to have mirror closer to vehicle as possible to avoid being knocked off. Sun glare, rear view mirror causes adjustment, poor visibility on passenger side. Must roll window down to see down side of vehicle - mirrors vibrate too much to use. Too much sun glare. Driver's side mirror is difficult to see down vehicle. Passenger mirror is useless. Blind spot from windshield to side window. Blind spot on passenger's side. Can't see out passenger side - mirror. Mirrors came loose. Glare from sun, passenger side obscured, passenger side mirror ineffective. Couldn't get a clear view while making left turns. Had to reposition. One left turn blind spot. Had to stick head out window to back up. Center post

blinds you. Width of vehicle makes it difficult to see. A lot of blind spots. Mirrors too small. Mirrors loose - out of adjustment. Can't see out of plastic side. Side windows are blocked by mirrors. Left mirror blocks. Side mirrors vibrate and move. Mirrors may not need to be big if properly located. Difficult seeing traffic from right. Blind spot exists at right windshield pillar and passenger soft door. Mirrors come loose too easily. If kept adjusted, sometimes mirror drops.

Is the driver's view unobstructed when driving:

71. Forward? [Yes = 14, No = 8, NA = 2]

72. Backward? [Yes = 9, No = 12, NA = 3]

Comments: Divider strip in windshield. Right side can't see in front. Can't see on right side. Short driver would have a problem. Mirrors located in poor position and vibrate too much. Need better mirrors. Blind spots - forward. Back up not good. Windshield post obscures view for left turns. Can't see out passenger mirror - needs repositioning. Cannot get a clear view of sides. Left side windshield pillar blind spot. Exhausts pipe on marine HMMWV block left side rear view. Mirrors are too small. A lot of mirror vibration. Window frame causes blind spots. Right side mirror is impossible to see.

Usability of controls and displays

Can you reach and operate the following driving controls easily:

Steering wheel:

73. Parked? [Yes = 23, No = 1, NA = 0]

Comments: No power assist.

74. Primary and Secondary roads? [Yes = 24, No = 0, NA = 0]

75. Cross-country? [Yes = 24, No = 0, NA = 0]

Shift lever:

76. Parked? [Yes = 24, No = 0, NA = 0]

77. Primary and Secondary roads? [Yes = 24, No = 0, NA = 0]

78. Cross-country? [Yes = 24, No = 0, NA = 0]

Gas pedal:

79. Parked? [Yes = 24, No = 0, NA = 0]

80. Primary and Secondary roads? [Yes = 24, No = 0, NA = 0]

81. Cross-country? [Yes = 24, No = 0, NA = 0]

Brake pedal:

82. Parked? [Yes = 24, No = 0, NA = 0]

83. Primary and Secondary roads? [Yes = 24, No = 0, NA = 0]

84. Cross-country? [Yes = 23, No = 1, NA = 0]

Parking brake:

85. Parked? [Yes = 24, No = 0, NA = 0]

86. Primary and Secondary roads? [Yes = 23, No = 1, NA = 0]

87. Cross-country? [Yes = 23, No = 1, NA = 0]

Comments: Shifting high/low stiff - brake pedal too far away. When bouncing, brake pedal is harder to use. Difficult to use windshield wiper control without affecting steering. Swerved to left while turning wipers on.

Can you reach and operate the following accessory controls easily?

88. Ignition/starter control? [Yes = 24, No = 0, NA = 0]

89. Lights? [Yes = 24, No = 0, NA = 0]

90. Windshield wiper? [Yes = 14, No = 10, NA = 0]

91. Heater/ventilation? [Yes = 22, No = 2, NA = 0]

92. Radio? [Yes = 12, No = 3, NA = 9]

Comments: Windshield -- short people will have trouble. Angle to access radio poor. Must stretch to reach wiper control.

Can you adequately read and interpret the following displays:

Daytime:

93. Speedometer? [Yes = 21, No = 2, NA = 1]

94. Tachometer? [Yes = 4, No = 0, NA = 20]

95. Fuel Gauge? [Yes = 22, No = 1, NA = 1]

96. Electrical Gauge(s)? [Yes = 22, No = 1, NA = 1]

97. Temperature Indicator? [Yes = 22, No = 1, NA = 1]

98. Air Pressure Gauge? [Yes = 14, No = 0, NA = 10]

99. Radio Indicators? [Yes = 9, No = 3, NA = 12]

100. Accessory Indicators? [Yes = 22, No = 0, NA = 2]

Night:

101. Speedometer? [Yes = 2, No = 0, NA = 22]

102. Tachometer? [Yes = 0, No = 0, NA = 24]

103. Fuel Gauge? [Yes = 2, No = 0, NA = 22]

104. Electrical Gauge(s)? [Yes = 2, No = 0, NA = 22]

105. Temperature Indicator? [Yes = 2, No = 0, NA = 22]

106. Air Pressure Gauge? [Yes = 0, No = 1, NA = 23]

107. Radio Indicators? [Yes = 1, No = 0, NA = 23]

108. Accessory Indicators? [Yes = 2, No = 0, NA = 22]

Comments: Reflection obscures speedometer, also electrical gauge and temperature. Bars in steering wheel and wheel itself block speedometer. Sometimes difficult to see fuel gauge - must look around steering wheel.

Driver Checklist

These checklist items were answered by 21 drivers.

21. Were there any problems during the PMCS (procedures, documentation, etc.) before this mission/scenario? If YES explain.
[Yes = 3, No = 16, NA = 2]

Comments: Heater is inoperable. Not enough lighting. Difficult to see with flashlight.

22. Were there any problems with the side doors, rear doors, or steps during this mission/scenario? If YES explain. [Yes = 10, No = 11, NA = 0]

Comments: Doors of rear compartment have come open during travel - hard to close. Steps sometimes difficult to open and close. Rear doors don't close completely and the steps seem to stick when pushing the lever. Difficulty lowering rear steps. Rear step assembly hard to open. Plastic cover makes excessive noise. Steps were hard to open. Back door (R) handle, inside, keeps coming off. Back door (R) keeps opening. Step doesn't go down easily and latch (release) doesn't work effectively. The vehicle needs new rear doors. Steps awkward at night and stick when unlatching.

23. Were there any problems loading, storing, accessing, or unloading any of the equipment during this mission/scenario? If YES explain.
[Yes = 3, No = 18, NA = 0]

Comments: Straps get in the way. The litter rack is worthless. Blanket sets and leg splints tracked stuff. Cover easy access to rear.

24. Were there any problems with the seating or ride quality during this mission/scenario? If YES explain. [Yes = 8, No = 13, NA = 0]

Comments: Seat very uncomfortable. Seats are too hard (not comfortable). Yes, seats uncomfortable for a long distance time. Seats are too hard and too straight. Bumpy and uncomfortable while riding on trails. Rear seating has no padding.

25. Were there any noise problems during this mission/scenario? If YES explain. [Yes = 14, No = 7, NA = 0]

Comments: Difficult not only to hear T.C.; extremely difficult to hear attendant. The lighting coils in the rear will slap against the side of the walls and the engine noise level is high. Air conditioning makes humming noise. The engine and ventilation system. Engine fan. Excessive engine and tire noise. Back flap, at around 25 mph or more, flaps around too much. Fan in engine makes a lot of noise. From engine and tires - couldn't understand passenger. A lot of racket in the back compartment - equipment (light cords) rattle around. Too noisy to really hear. Everything strap or litter and sideboard rattles. Loud engine noise.

26. Were there any problems with crew communication (verbal or visual) during this mission/scenario? If YES explain. [Yes = 8, No = 12, NA = 1]

Comments: While driving, it's hard to hear the attendant over the engine noise. Engine noise and fan. Excessive engine and tire noise. Yes, fan was too noisy. Noise from engine and tires. It's hard for attendant in back to communicate with driver.

27. Were there any problems with radio communication during this mission? If YES explain. [Yes = 1, No = 11, NA = 9]

Comments: No radio.

28. Were there any problems with the ventilation system for heating/cooling or fumes/dust during this scenario? If YES explain.
[Yes = 14, No = 6, NA = 1]

Comments: Excessive dust. Ventilation needs better filters. Very dusty. Air conditioning inoperative - collects dust in vent systems. Tremendous amount of heat from transfer case area and around the passenger foot area. There is a problem with ventilation system for heating and cooling. Dust comes through back flap and around doors. Ventilation system inoperative. Heater is inoperative while windows were closed and air conditioning was on. Dust was thick both in front and back of vehicle. No heat. It was a cool night.

29. Were there any problems with the driver working space during this scenario? If YES explain. [Yes = 7, No = 14, NA = 0]

Comments: My right knee sometimes hit up against the throttle. Speedometer hard to see for steering wheel. When using the dim/bright light switch, I step on brakes by mistake. No room for legs and arms. Legs became very cramped - very uncomfortable.

30. Were there any problems seeing the road/obstacles or using the mirrors during this mission? If YES explain. [Yes = 8, No = 13, NA = 0]

Comments: Mirrors often become loose and fall from vision. Mirrors are too small. While looking in mirror, you can see more of the vehicle than what's behind you. Passenger mirror - not able to see out of. The road was lit up like an airfield, I mean really stupid! Mirrors loose - right mirror totally out of driver's sight.

31. Were there any problems reaching or using the driving controls during this mission/scenario? If YES explain. [Yes = 3, No = 18, NA = 0]

Comments: Problems with reaching for the windshield wiper on/off switch. Hard to reach windshield wipers from driver's seat.

32. Were there any hazardous or unsafe conditions during this mission scenario? If YES explain. [Yes = 4, No = 17, NA = 0]

Comments: Road was very difficult to see due to the excessive amounts of dust due to the strong wind. How can there be at 5 mph? Setting up loading litter and loading patients - extremely dangerous.

33. Were there any problems with the vehicle lights during this mission/scenario? If YES explain. [Yes = 4, No = 17, NA = 0]

Comments: The front running lights were inoperable. Need more blackout lights in rear.

34. Were there any problems with vehicle handling or negotiation of any of the terrain encountered during this scenario? If YES explain.
[Yes = 1, No = 20, NA = 0]

Comments: While driving on highway, whenever the vehicle exceeds down a slope, it seems to have very high wind resistance.

35. Were there any problems with the run flat tires or vehicle handling with flat tires? If YES explain. [Yes = 0, No = 7, NA = 14]

36. Were there any problems towing a trailer during this scenario? If YES explain. [Yes = 1, No = 3, NA = 17]

37. Were there any problems recovering or towing a recovered vehicle during this scenario? If YES explain. [Yes = 0, No = 3, NA = 18]

38. Were there any problems reaching or using the accessory equipment or controls during this mission? If YES explain. [Yes = 4, No = 11, NA = 6]

Comments: All equipment is wrapped up - needs to be more accessible, especially stuff in aid and trauma bag. Suggestion: Overhead and side compartment.

Sheltercrew Interview

Responses from 12 sheltercrew personnel are presented below.

Entry

13. Are the side doors adequate to enter or exit your assigned position? [Yes = 7, No = 3, NA = 2]

Comments: Door handles - hard to close. Door levers don't hold door closed. If vehicle is hit hard, door opened. Difficult to pull and lift door latch/handles. Doors should be like the ambulance doors - hard. Knee hits side panel upon entry. Door must be lifted to ensure closure. Plastic handle flimsy. Door latches not secure - can't lock.

Are the mounted shelter steps/door adequate to enter or exit your assigned position under the following conditions:

14. Not Generator trailer mounted? [Yes = 4, No = 6, NA = 2]

15. Generator trailer mounted? [Yes = 6, No = 4, NA = 2]

Comments: Seems to be a real safety hazard caused by the space when tailgate is down. Foot can easily get caught. When tail is down, there's a large gap that your foot can get caught in causing you to trip. Slip in space between shelter and back deck of vehicle. Foot wedged in that space. Space exists between shelter and tailgate that acts as a trip.

Seating

Is the passenger seat adjustment adequate:

16. Up-Down? [Yes = 0, No = 5, NA = 7]

Comments: Does not adjust; needs to position passenger for best visibility to implement driver's vision.

17. Front-Back? [Yes = 0, No = 5, NA = 7]

Comments: No adjustment available. Doesn't adjust. Left turns - the Marine HMMWV, the left induction vent (fording) kit blocks view to left. Legs cramped. Not adjustable; poor seating comfort - needs more padding.

Was the passenger seat and safety belt adequate for the following traveling conditions:

18. Primary Roads? [Yes = 6, No = 5, NA = 1]

19. Secondary Roads? [Yes = 5, No = 5, NA = 2]

Cross-country:

20. Up-Down Slopes (=> 10%)? [Yes = 4, No = 6, NA = 2]

21. Across Slopes? [Yes = 3, No = 7, NA = 2]

22. Level Ground? [Yes = 4, No = 6, NA = 2]

23. Towing a vehicle? [Yes = 0, No = 0, NA = 12]

24. Towing a trailer? [Yes = 1, No = 6, NA = 5]

Comments: Lack of side to side restraint, uncomfortable, hurt to neck and back. Seat shoulder restraint requested. Need more padding. Back is too forward.

25. Start-Stop Driving? [Yes = 3, No = 8, NA = 1]

Comments: Even with belt on, the individual is not securely fastened. Belts are not secure enough. Slip inside the belt when it's on. Can't hold on to anything; need grab rails. Belts don't have a positive restraining position to keep from going forward.

26. Turning @ 15 mph or higher? [Yes = 5, No = 5, NA = 2]

27. Traveling more than two HRS? [Yes = 3, No = 7, NA = 2]

Comments: Uncomfortable, not enough padding. Need shoulder restraint.

Communications inside vehicle, and radio

Was the communication between the crewmembers adequate under the following conditions:

28. When parked? [Yes = 12, No = 0, NA = 0]

When driving:

29. Primary Roads @ > 25 mph? [Yes = 5, No = 6, NA = 1]

30. Secondary Roads? [Yes = 6, No = 6, NA = 0]

Comments: If fan kicks on, you can't hear anything. Back flap makes noise on hard ball. Nothing between crew and shelter - safety. When fan comes on, it's too loud to talk over. Background vehicle noise excessive; must talk loud or high. Rear flap makes too much noise, especially on primary roads at traveling speed.

31. Cross-country? [Yes = 7, No = 5, NA = 0]

Comments: Back flap snaps when on hard road (primary road), causes a lot of noise. When engine fan comes on, it is too loud to talk over. Rear flaps make too much noise.

32. When using the intercom? [Yes = 2, No = 0, NA = 10]

Comments: Yes, but have to speak loud. Vehicle not that loud. Excessive engine noise at high rpm.

Was the volume/clarity of radio messages adequate in the vehicle:

Parked:

33. Engine off? [Yes = 5, No = 0, NA = 7]

34. Engine idling? [Yes = 5, No = 0, NA = 7]

Driving:

35. Primary Roads @ > 25 mph? [Yes = 2, No = 3, NA = 7]

36. Secondary Roads? [Yes = 2, No = 3, NA = 7]

37. Cross-country? [Yes = 2, No = 3, NA = 7]

Comments: Used walkie-talkie. Note: This crew has the Marine Corps vehicle and the exhaust comes up at the driver's door - creates noise.

Was it easy for the passenger to reach and operate the radio controls:

38. When parked? [Yes = 0, No = 0, NA = 12]

When driving:

39. Primary Roads? [Yes = 0, No = 0, NA = 12]

40. Secondary Roads? [Yes = 0, No = 0, NA = 12]

41. Cross-country? [Yes = 0, No = 0, NA = 12]

Comments: If radio had been mounted, to reach would be easy. Lots of room.

Ventilation

Was the ventilation (air flow) adequate for cooling/heating under the following conditions:

Windows/vents open:

42. Vehicle standing? [Yes = 7, No = 3, NA = 2]

43. Vehicle moving? [Yes = 8, No = 3, NA = 1]

Comments: Heating alright. Not enough for cooling; vehicle is way too hot. Engine heat excessive, for heating either too hot or not hot enough, not as adjustable as CVCV. Driver's compartment too drafty. Should put a hard top on it.

Windows/vents closed:

44. Vehicle standing? [Yes = 6, No = 5, NA = 1]

Comments: No experience.

45. Vehicle moving? [Yes = 5, No = 6, NA = 1]

Comments: Heating is alright. Cooling is inadequate. No cooling (A/C) for this. Poor for hot climate. When fan comes on, engine heat is excessive in cab. Problem with soft top drafts and flaps making noise. Vents give off hot engine heat. It was not. There is not air every time fan is turned on.

Was the ventilation system adequate for eliminating dust and fumes under the following conditions:

Windows/vents open:

46. Vehicle standing? [Yes = 6, No = 4, NA = 2]

47. Vehicle on primary roads? [Yes = 7, No = 4, NA = 1]

48. Secondary roads & cross-country? [Yes = 5, No = 6, NA = 1]

Windows/vents closed:

49. Vehicle standing? [Yes = 7, No = 4, NA = 1]

50. Vehicle on primary roads? [Yes = 7, No = 4, NA = 1]

51. Secondary roads & cross-country? [Yes = 6, No = 5, NA = 1]

Comments: Dust creeps in through back flap. No fuel or exhaust fumes. Odor from burning brakes. Dust comes from underside at back flap around doors and introduced through vents.

Was the shelter air conditioning/ventilation (air flow) adequate for cooling/-heating under the following conditions?

Windows/vents open:

52. Vehicle standing motor off? [Yes = 4, No = 2, NA = 6]

Comments: None in shelter. Fans only for equipment. Shelters not used in Phase II. No air. Shelter has blowers.

53. Vehicle standing motor running? [Yes = 3, No = 3, NA = 6]

Windows/vents closed:

54. Vehicle standing motor off? [Yes = 3, No = 2, NA = 7]

55. Vehicle standing motor running? [Yes = 2, No = 2, NA = 8]

Comments: S-250 shelter sealed; no vents. Shelters have not be used in Phase II. No experience. With vehicle running, exhaust in shelter is very noticeable.

Noise

Was the noise level in the shelter acceptable (low) under the following conditions:

Windows/vents/doors open:

56. Motor off? [Yes = 8, No = 0, NA = 4]

57. Motor running? [Yes = 6, No = 1, NA = 5]

58. Motor and generator running? [Yes = 6, No = 1, NA = 5]

Windows/vents/doors closed:

59. Motor off? [Yes = 7, No = 0, NA = 5]

60. Motor running? [Yes = 7, No = 0, NA = 5]

Comments: With motor running, noise combined with shelter equipment noise is too high.

61. Motor and generator running? [Yes = 7, No = 0, NA = 5]

Working space

Is your station in the vehicle adequate for doing your tasks in terms of the following:

62. Overall space for crew? [Yes = 8, No = 3, NA = 1]

63. Arm and elbow room? [Yes = 8, No = 3, NA = 1]

Comments: Needs arm rest and suggest raise seat. Leg room cramped; hits dash. Angle to reach brake poor if legs are long.

64. Leg and knee room? [Yes = 5, No = 6, NA = 1]

Comments: Team is a 3-man - can only carry 2; need another vehicle. Cramped for tall individuals. Need more leg space and a right arm rest.

65. Headroom? [Yes = 11, No = 0, NA = 1]

Comments: Need extra seat for 3rd team member. Difficult to enter and exit passenger side of vehicle.

Visibility

Is the passengers' visibility adequate through the following:

66. Windshield? [Yes = 10, No = 2, NA = 0]

67. Side windows? [Yes = 6, No = 6, NA = 0]

Comments: Side window hard to see through due to it being plastic. Plastic windows are fading. Windows scratch too easily. Center windshield is a blind spot. Air filter induction on Marine vehicle obstructs view to left. Mirrors must come forward and up to see out properly. Can barely see out side windows. Mirrors vibrate and distort view.

Is the passengers' view unobstructed in the direction of travel:

68. Forward? [Yes = 10, No = 0, NA = 2]

Comments: Front rest causes blind spot on left hand turn. Why not use hard door like amb.? In a turn, the shelter obstructs view.

69. Backward? [Yes = 7, No = 3, NA = 2]

Comments: With use of ground van. Backing with mirrors inadequate; need to be larger, similar to 2-1/2 ton vehicles. Mirrors come loose too easily. Right rear view mirror difficult to adjust.

Usability of controls and displays

Can the following accessory controls be reached and operated easily?

70. Ignition/starter control? [Yes = 6, No = 6, NA = 0]

Comments: Can't be reached by passenger. Windshield wiper is difficult for driver to reach.

71. Lights? [Yes = 7, No = 5, NA = 0]

72. Windshield wiper? [Yes = 9, No = 3, NA = 0]

73. Heater/ventilation? [Yes = 7, No = 4, NA = 1]

Comments: Difficult, but must go over radio. Heater placed on far left. If driver was wounded, passenger could not reach passenger brake.

74. Radio? [Yes = 5, No = 0, NA = 7]

75. Parking brake? [Yes = 8, No = 4, NA = 0]

Comments: Controls too far to reach from passenger position.

Are the following displays readable and understandable from the passenger's seat:

76. Ventilation system indicators? [Yes = 5, No = 4, NA = 3]

77. Cooling/heating indicators? [Yes = 5, No = 6, NA = 1]

Comments: Label on heater switch too small light.

78. Radio indicators? [Yes = 3, No = 1, NA = 8]

Comments: With radios on housing, passenger cannot see controls.

79. Lighting indicators: [Yes = 2, No = 9, NA = 1]

Comments: Cannot tell if lights are left on.

Can the accessories be easily accessed and used/connected under the following conditions:

Generator not mounted:

80. Camouflage netting? [Yes = 4, No = 2, NA = 6]

81. Power cables? [Yes = 12, No = 0, NA = 0]

82. Antenna components? [Yes = 12, No = 0, NA = 0]

83. RF cables? [Yes = 12, No = 0, NA = 0]

84. Pioneer tools? [Yes = 11, No = 0, NA = 1]

Generator mounted:

85. Camouflage netting? [Yes = 4, No = 2, NA = 6]

86. Power cables? [Yes = 11, No = 0, NA = 1]

87. Antenna components? [Yes = 11, No = 0, NA = 1]

88. RF cables? [Yes = 11, No = 0, NA = 1]

89. Pioneer tools? [Yes = 11, No = 0, NA = 1]

Comments: Equipment: Camo, water jugs, access. bags removed to reduce vehicle weight.

Mounting equipment

90. Can the shelter be easily mounted/dismounted on the vehicle? [Yes = 4, No = 8, NA = 0]

Comments: The vehicle crew interviewed had the old shelter and it fit. Leveling shelter difficult. Bolts seem inadequate for secure shelter installation. Bolt holes and mount holes must be exactly aligned. Many vans do not have appropriate screw holes. Screw holes are often in the wrong place. AN/TRC 113 light vans are the lightest vans with the least equipment. Heavier vans won't work, too heavy for weight of loaded vehicle. Must remove both front seats to get to front mounting brackets. Design is not strong enough. Bolts break, takes too many people to remove hooks and to align. Require too many tools and too much time (1 hr., 30 min.). Eight bolts for mounting are not strong enough. Need capacity for over 11,800 lbs. in order to carry all gear. HMMWV is configured for 2 people and we need 3. The extra weight and extra person will require an extra support vehicle. Safety hazards: 1) If back bolts break, van will slide into driver's compartment; if bolts are sheared, often it cannot be detected. 2) The weight of a top loaded van will put more side to side stress on mounts. 3) HMMWV wheel rims won't balance, rims will bend. Weight of loaded van will cause more bent wheel rim. 4) Brakes are burning. Brakes have burned twice on my truck. Weight will increase problem. 5) Right front tire hits air cleaner. More weight puts tire closer.

91. Can the generator trailer be easily mounted/dismounted on the vehicle? [Yes = 11, No = 0, NA = 1]

Sheltercrew Checklist

Eleven sheltercrew personnel answered these items.

21. Were there any problems during the PMCS (procedures, documentation, etc.) before this mission/scenario? If YES explain.
[Yes = 3, No = 8, NA = 0]]

Comments: Steps weren't complete. Outdated TM. Boots (ball-joints).

22. Were there any problems with the doors during this mission/scenario? If YES explain. [Yes = 6, No = 5, NA = 0]

Comments: No protection - difficult to close. Hard to close - no protection. Doors are hard to close. Hard door, hard top. Some doors don't latch properly. Sometimes doors hard to close.

23. Were there any problems loading, storing, accessing, or unloading any of the equipment during this scenario? If YES explain.
[Yes = 5, No = 6, NA = 0]

Comments: Shelters are very difficult to install. Tailgate has enough room to put your foot in and break a leg. The back gate (door) has too much space in between truck and van. Items inside the commo shelter bounced around and were damaged. You have to be careful loading or unloading your van because of space in rear bumper.

24. Were there any problems with the passenger seating during this mission scenario? If YES explain. [Yes = 5, No = 3, NA = 3]

Comments: Uncomfortable ride. Extremely uncomfortable. Passenger sits on a hard surface which causes lower back strain and/or discomfort. Passenger complains that it's uncomfortable. Passenger seat tends to heat up. Also, not much leg room.

25. Were there any noise problems during this mission/scenario? If YES explain. [Yes = 8, No = 3, NA = 0]

Comments: Engine fan and compartment on the inside very noisy. Engine is loud and plastic flaps like a loud whip. Noise from engine and tires. It's hard to hear your data collector while engine is running. Excessive engine noise. The back flap on cover excessive noise. Can't hear when fan turns on. Also, tarp flaps at higher speeds. Hard to hear - you have to raise your voice more than normal.

26. Were there any problems with crew communication (verbal or visual) during this mission/scenario? If YES explain. [Yes = 7, No = 3, NA = 1]

Comments: Because of noise from engine. Hard to talk from crew to crew due to engine noise. When fan turns on. Talking-wise. Driver cannot see out passenger mirror.

27. Were there any problems with radio operation/communication during this mission/scenario? If YES explain. [Yes = 1, No = 5, NA = 5]

28. Were there any problems with the ventilation system for heating/cooling or fumes/dust during this scenario? If YES explain.
[Yes = 10, No = 1, NA = 0]

Comments: Vehicle gets very hot - no cool air in vehicle. Only hot air comes out of ventilator. Lots of dust and no cooling. Vehicle's ventilation system does not clear dust from the air or cool. Not enough ventilation - too much dust getting into cab. Not enough ventilation (cooling). Not enough cool air gets in for circulation.

29. Were there any problems with the crew working space during this scenario? If YES explain. [Yes = 3, No = 7, NA = 1]

Comments: Not enough room. Not enough leg room.

30. Were there any problems seeing obstacles from the passenger position during this mission? If YES explain. [Yes = 5, No = 2, NA = 4]

Comments: Seats are too low. Mid-bar in windshield was also a problem. Left side has a big blind spot which makes left turns dangerous. Very hard to see trailer. Also, the rear view mirrors are too small. Cannot see out pass side from driver's seat.

31. Were there any problems reaching and/or operating any of the accessory equipment controls (heater, radio, etc.), the fire extinguisher, or other emergency equipment during this mission/ scenario? If YES explain.
[Yes = 5, No = 6, NA = 0]

Comments: Hard to reach window wiper control while vehicle is in motion. Considered a safety hazard. Everything. Speedometer is difficult to read because of steering wheel. Windshield wipers. The wipers.

32. Were there any hazardous or unsafe conditions during this mission/scenario? If YES explain. [Yes = 3, No = 7, NA = 1]

Comments: A gap between the shelter and tailgate could create injury to personnel. Space between the van and tailgate. Insufficient brakes.

33. Were there any problems with the vehicle lighting during this mission scenario? If YES explain. [Yes = 0, No = 8, NA = 3]

34. Were there any problems with the shelter tiedowns during this mission scenario? If YES explain. [Yes = 2, No = 9, NA = 0]

Comments: The best tiedown system I have ever seen. Four screws cannot hold a 2000-lb. shelter. Shelter is only bolted with 4 bolts and may break during a roll.

35. Were there any problems mounting or dismounting the shelter or generator trailer during this scenario? If YES explain. [Yes = 4, No = 6, NA = 1]

Comments: Very difficult and time consuming to mount. Generators don't take bumps as well as the HMMWV. The driver can't judge when to slow down to save wear-and-tear on generators and the trailer.

36. Were there any problems towing a trailer during this scenario? If YES explain. [Yes = 7, No = 4, NA = 0]

Comments: Trailer gets a beating because you can't see or feel it while driving. Hard to see the trailer behind the vehicle.

37. Were there any problems recovering or towing a recovered vehicle during this scenario? If YES explain. [Yes = 0, No = 3, NA = 8]

38. Were there any problems gaining access or connecting equipment to the mounted shelter during this mission/scenario? If YES explain.
[Yes = 2, No = 9, NA = 0]

Maintainers Interview

Eight maintainers were interviewed during test phase 2 and nine during test phase 3.

Were there any problems during routine maintenance of the BATTERIES in terms of:

13. Gaining access?

Phase 2: Yes = 0, No = 8, NA = 0 Phase 3: Yes = 0, No = 9, NA = 0

Comments: These tasks are operator tasks not maintainers.

14. Checking/adding fluid?

Phase 2: Yes = 0, No = 7, NA = 1 Phase 3: Yes = 1, No = 8, NA = 0

15. Checking/tightening cables?

Phase 2: Yes = 0, No = 8, NA = 0 Phase 3: Yes = 0, No = 9, NA = 0

Were there any problems during routine maintenance of the ENGINE in terms of:

16. Gaining access?

Phase 2: Yes = 5, No = 3, NA = 0 Phase 3: Yes = 4, No = 5, NA = 0

Comments: Difficulty accessing passenger side exhaust manifold bolts. Injector tubing hold down bolts on valve covers. Generator replacement difficult. Everything compact and hard to get to. Starter very difficult. Clutch fan. CDR valve is stuck out of the way. Access to starter motor and difficult to remove. Access to transmission panel requires starter and exhaust crossover tube removal. Difficult to get to glow plugs. Plug #8, #7 take extra time. Also, right side exhaust manifold bolts frame is too close to manifold bolts.

17. Checking/adding fluids?

Phase 2: Yes = 4, No = 4, NA = 0 Phase 3: Yes = 4, No = 5, NA = 0

Comments: Power steering difficult. Power steering pumps hard to get to. Difficult to add power steering fluid; must have long-neck funnel.

18. Checking/changing air filter?

Phase 2: Yes = 1, No = 5, NA = 2 Phase 3: Yes = 1, No = 7, NA = 1

Comments: Clip on air filter was breaking off.

19. Checking/draining fuel filter?

Phase 2: Yes = 2, No = 4, NA = 2 Phase 3: Yes = 0, No = 9, NA = 0

Comments: Very difficult to get to. Can't get a slop container under the petlock. Could use an extension drain hose.

Were there any problems during routine maintenance of the transmission, differential, or final drives in terms of:

20. Gaining access?

Phase 2: Yes = 2, No = 5, NA = 1 Phase 3: Yes = 0, No = 8, NA = 1

Comments: Bolt on transfer case at the top of the case needs an access port flow bed of HMMWV. Problem with getting the transmission inspection plat cover realigned for reinstallation.

21. Checking/adding/changing fluid?

Phase 2: Yes = 1, No = 4, NA = 3 Phase 3: Yes = 3, No = 6, NA = 0

Comments: Front gear hub plugs difficult to get to.

22. Greasing necessary fittings?

Phase 2: Yes = 0, No = 4, NA = 4 Phase 3: Yes = 0, No = 7, NA = 2

Were there any problems during routine maintenance of the suspension system in terms of:

23. Gaining access to suspension components?

Phase 2: Yes = 2, No = 3, NA = 3 Phase 3: Yes = 0, No = 8, NA = 1

Comments: Lower ball joint bolts hard to get to to torque them down. Cross member is difficult to remove.

24. Greasing necessary fittings?

Phase 2: Yes = 0, No = 6, NA = 2 Phase 3: Yes = 0, No = 6, NA = 3

25. Repairing, replacing, or adjusting components?

Phase 2: Yes = 0, No = 2, NA = 6 Phase 3: Yes = 2, No = 5, NA = 2

Comments: Did have problems with ball joints — too much weight on them and they cracked.

Were there any problems during routine maintenance with the built in test equipment (BITE) in terms of:

26. Gaining access to the BITE?

Phase 2: Yes = 0, No = 1, NA = 7 Phase 3: Yes = 0, No = 0, NA = 9

27. Operating the BITE?

Phase 2: Yes = 1, No = 0, NA = 7 Phase 3: Yes = 0, No = 0, NA = 9

Comments: Need a class on it. Manual doesn't explain it well.

28. Interpreting the BITE output?

Phase 2: Yes = 1, No = 0, NA = 7 Phase 3: Yes = 0, No = 0, NA = 9

29. Using the BITE output to identify needed repairs?

Phase 2: Yes = 0, No = 0, NA = 8 Phase 3: Yes = 0, No = 0, NA = 9

Were there any problems during routine maintenance of the lighting system in terms of:

30. Exterior lighting components?

Phase 2: Yes = 3, No = 2, NA = 3 Phase 3: Yes = 3, No = 3, NA = 3

Comments: Burn out quite a bit. Wiring stuck out of the way between body and frame; can't see up in there. Brake light switch at pedal slides out of adjustment easily.

31. Interior lighting components?

Phase 2: Yes = 1, No = 3, NA = 4 Phase 3: Yes = 3, No = 4, NA = 2

Comments: Bulbs for surgical lights have failed often.

Were there any problems during routine maintenance of the communication system in terms of:

32. Exterior components?

Phase 2: Yes = 0, No = 0, NA = 8 Phase 3: Yes = 0, No = 0, NA = 9

33. Interior components?

Phase 2: Yes = 0, No = 0, NA = 8 Phase 3: Yes = 0, No = 0, NA = 9

Comments: Como tasks. Radio mount is in way of engine access cover.

Were there any problems during maintenance caused by the following:

34. Tools not in the tool kit?

Phase 2: Yes = 6, No = 1, NA = 1 Phase 3: Yes = 6, No = 2, NA = 1

Comments: Need 1/4-inch drive socket set. Wrench for removing bolt for throttle cable bracket to manifold. Had to order some special tools. Not issued special tools. Need special tool for popping out expanded glow plugs.

35. Test equipment not available?

Phase 2: Yes = 2, No = 5, NA = 1 Phase 3: Yes = 0, No = 7, NA = 2

Comments: Don't have most of what you need. No timing set-up.

36. Maintenance manuals not clear?

Phase 2: Yes = 4, No = 4, NA = 0 Phase 3: Yes = 4, No = 5, NA = 0

Comments: Hardly use the manuals. Wrong information. Problems with R&R for rear brake cables. Answer not clear and don't have regular HMMWV manuals. No problems. Supplements to -34 not sufficient for starter removal. Starter: a) cut a bolt because it hit motor mount; b) no step-by-step procedures for removal and replacement; c) easiest to remove transmission access panel. Brakes: No procedure for repair if caliper pads bind and overheat.

37. Maintenance manuals missing steps?

Phase 2: Yes = 1, No = 7, NA = 0 Phase 3: Yes = 2, No = 7, NA = 0

Comments: Access to rear main bearing.

38. Maintenance manuals have incorrect information?

Phase 2: Yes = 2, No = 6, NA = 0 Phase 3: Yes = 2, No = 6, NA = 1

Comments: Sometimes

39. Parts lists incomplete?

Phase 2: Yes = 3, No = 5, NA = 0 Phase 3: Yes = 3, No = 5, NA = 1

Comments: IV and safety straps for mini-ambulance not listed.

40. Parts lists have wrong information?

Phase 2: Yes = 4, No = 3, NA = 1 Phase 3: Yes = 2, No = 4, NA = 3

Comments: Steps latch sent was received with the latch lever reversed. Ordered for rear steps and got the wrong part. Ambulance steps latch order and received, but is configured with latch arm inverted. Old latch rebuilt. No access panel exists as shown in manual to back up latch mounting nuts.

41. (& 3.6.5.25) PMCS not done properly?

Phase 2: Yes = 3, No = 4, NA = 1 Phase 3: Yes = 5, No = 4, NA = 0

Comments: Operators don't know what they're doing. Doesn't explain as well as it should.

Were there any problems with removal or replacement of any of the vehicle components:

42. Filters?

Phase 2: Yes = 1, No = 6, NA = 1 Phase 3: Yes = 0, No = 7, NA = 2

Comments: Fuel filters.

43. Engine?

Phase 2: Yes = 1, No = 2, NA = 5 Phase 3: Yes = 3, No = 5, NA = 1

Comments: This is a DS task. Difficult and time consuming to remove.

44. Starter/flywheel?

Phase 2: Yes = 5, No = 2, NA = 1 Phase 3: Yes = 6, No = 2, NA = 1

Comments: Top cramped. Difficult to access upper bolt. Removal requires great effort. Must remove transmission inspection cover. Refer to revised starter removal procedure noted in Question #36. Difficult procedure, takes two people to remove.

45. Gear hub?

Phase 2: Yes = 1, No = 2, NA = 5 Phase 3: Yes = 0, No = 5, NA = 4

46. Lubrication system components?

Phase 2: Yes = 0, No = 3, NA = 5 Phase 3: Yes = 0, No = 7, NA = 2

47. Cooling system components?

Phase 2: Yes = 1, No = 5, NA = 2 Phase 3: Yes = 6, No = 3, NA = 0

Comments: Upper radiator hose in way of power steering components.

48. Fuel system components?

Phase 2: Yes = 3, No = 4, NA = 1 Phase 3: Yes = 5, No = 4, NA = 0

Comments: Gas tank - troubleshooting back difficult. Fuel tank on right side, muffler system on left. Hard to get to wiring and parking brake system. Don't have proper tool to break fuel lines from injection pump.

49. Electrical system components?

Phase 2: Yes = 4, No = 3, NA = 1 Phase 3: Yes = 3, No = 5, NA = 1

Comments: Wires hard to get to. Generator bolts and brackets cheap and flimsy. Need procedure for locating and positioning engine wiring harness during engine removal.

50. Wheels, tires, and run-flat devices?

Phase 2: Yes = 0, No = 8, NA = 0 Phase 3: Yes = 3, No = 6, NA = 0

51. Drive train components?

Phase 2: Yes = 1, No = 7, NA = 0 Phase 3: Yes = 3, No = 5, NA = 1

Comments: Bolts come loose on differential - caliper mounts difficult to work with. Difficult to access; must lift engine to access front universal joints for drive shaft.

52. Suspension system components?

Phase 2: Yes = 2, No = 4, NA = 2 Phase 3: Yes = 3, No = 3, NA = 3

Comments: Difficulty removing front half shaft. Wound not slide forward or back enough to fill out. Cross member removal is difficult.

53. Service brake system components?

Phase 2: Yes = 2, No = 4, NA = 2 Phase 3: Yes = 3, No = 6, NA = 0

Comments: Lot of trouble — parking brake cable.

54. Winch?

Phase 2: Yes = 0, No = 1, NA = 7 Phase 3: Yes = 0, No = 0, NA = 9

55. Body components?

Phase 2: Yes = 3, No = 4, NA = 1 Phase 3: Yes = 2, No = 2, NA = 5

Comments: Hood hard to take off; should be easy. Hood pin holes don't line up. Mechanics use tape on end of hood pin to help align pins. Difficult to align hood pins; should taper pins or countersink hinge holes to assist alignment.

Were there any problems repairing or rebuilding any of the following:

56. Engine?

Phase 2: Yes = 0, No = 4, NA = 4 Phase 3: Yes = 0, No = 1, NA = 8

57. Starter/flywheel?

Phase 2: Yes = 1, No = 3, NA = 4 Phase 3: Yes = 0, No = 0, NA = 9

Comments: Hard to get out — in a bad place.

58. Gear hub?

Phase 2: Yes = 0, No = 3, NA = 5 Phase 3: Yes = 0, No = 0, NA = 9

59. Lubrication system components?

Phase 2: Yes = 0, No = 5, NA = 5 Phase 3: Yes = 0, No = 0, NA = 9

60. Cooling system components?

Phase 2: Yes = 0, No = 3, NA = 5 Phase 3: Yes = 0, No = 1, NA = 8

61. Fuel system components?

Phase 2: Yes = 1, No = 2, NA = 5 Phase 3: Yes = 0, No = 0, NA = 9

Comments: Gas tank and fuel filters.

62. Electrical system components?

Phase 2: Yes = 2, No = 2, NA = 4 Phase 3: Yes = 0, No = 2, NA = 7

Comments: Getting to wiring difficult.

63. Wheel, tires, and run-flat devices?

Phase 2: Yes = 0, No = 5, NA = 3 Phase 3: Yes = 1, No = 7, NA = 1

64. Drive train components?

Phase 2: Yes = 0, No = 4, NA = 4 Phase 3: Yes = 0, No = 2, NA = 7

65. Suspension system components?

Phase 2: Yes = 0, No = 3, NA = 5 Phase 3: Yes = 0, No = 3, NA = 6

66. Service brake system components?

Phase 2: Yes = 2, No = 4, NA = 2 Phase 3: Yes = 1, No = 4, NA = 4

Comments: Must adjust the hand brake cable housing along with plate that secures cable housing to caliper. No instructions yet available; directed by AM General.

67. Winch?

Phase 2: Yes = 0, No = 1, NA = 7 Phase 3: Yes = 0, No = 0, NA = 9

Were there any problems during maintenance because of problems with the following manuals:

68. -10 Operators Manual?

Phase 2: Yes = 1, No = 5, NA = 2 Phase 3: Yes = 1, No = 5, NA = 3

Comments: Checking alternator belts for tightness.

69. -20 Organizational Maintenance Manual?

Phase 2: Yes = 2, No = 5, NA = 1 Phase 3: Yes = 2, No = 5, NA = 2

Comments: Sometimes; didn't explain adequately.

70. -20p Organizational Maintenance Manual?

Phase 2: Yes = 2, No = 5, NA = 1 Phase 3: Yes = 2, No = 5, NA = 2

71. -30 Direct Support Maintenance Manual?

Phase 2: Yes = 0, No = 3, NA = 5 Phase 3: Yes = 1, No = 5, NA = 3

72. -30p Direct Support Maintenance Manual?

Phase 2: Yes = 0, No = 3, NA = 5 Phase 3: Yes = 2, No = 4, NA = 3

73. Were there any problems caused by the type and quantity of PLL or ASC repair parts?

Phase 2: Yes = 4, No = 4, NA = 0 Phase 3: Yes = 2, No = 7, NA = 0

Comments: Parts bad when they cut them. Alternator bolts may be improper grade, not strong enough.

74. Were there any problems caused by the allocation of responsibilities for maintenance to OS, DS, and GS activities?

Phase 2: Yes = 2, No = 6, NA = 0 Phase 3: Yes = 4, No = 5, NA = 0

Comments: Always a problem. OS could do it with sending it DS. Org. should be able to fix expanded glow plugs.

Key Personnel Interview

Responses of eight key personnel to 62 interview questions are presented in this section.

8. Were there any problems with vehicle controls and indicators/gauges? [Yes = 3, No = 4, NA = 1]

Comments: Many soldiers experience difficulty reaching the windshield wipers. No training for use of intercom controls; need rear door steps indicator. Light control should lock out lights when in blackout operations.

9. Were there any problems with preventive maintenance checks and services (PMCS)? [Yes = 2, No = 4, NA = 2]

Comments: Troops need more up front training to understand PMCS for HMMWV. Troops should have been trained to procedures of PMCS.

10. Were there any problems with safety features of the vehicle? [Yes = 8, No = 0, NA = 0]

Comments: Locking hardware for litter racks, sharp edges on racks, need rounded corners. Troops have difficulty manipulating latches. Fewer sharp edges. Need restraints in back, belts should have ratchet tightening mechanisms. Many sharp edges. Lack of restraint devices for personnel. Drivers cannot sense the type or quality of ride given to persons in rear of ambulances. Need fire extinguishers with more capacity. Need to break the sharp edge near hood release at the edge of the hood (shelter carriers). Too many sharp edges in patient areas. Extinguisher location good. Hand strap assembly fasteners fail often. Positive rear door locks do not keep the rear doors of the ambulance closed. Steps sometimes fall without warning.

11. Were there any problems with the unique characteristics of the vehicle? [Yes = 6, No = 2, NA = 0]

Comments: After a test drive, mini-ambulance seems top heavy to the left. Maxi-ambulance and shelter seem to ride better and seem more stable. Operators are afraid the shelters (S-250) are not bolted secure enough. HMMWV-heavy variants ventilation system is not adequate for hot climates. Litter rack support strap fasteners have failed. Shelter HMMWV-HV drove excellent. Rear brake calipers have a propensity to lock up. Some ambulance bodies have had rivets fail, especially upper to corners above the windshield.

12. Were there any problems with the operation of the vehicle on primary roads, secondary roads, and cross-country? [Yes = 3, No = 4, NA = 1]

Comments: All handle approximately the same, except on cross-country. Felt shelter carrier could handle higher weight loads. Ambulance bodies seem to have too much flexibility. On cross-country, the ambulances rear doors came open due to design or ability of operators to close the doors properly. Also, too much dust gets into the vehicles. Great stability - need to reduce

or dampen shock that patients feel in ambulance rear. Incorporate a gas shock system. Vehicles handle good.

13. Were there any problems with the operation of the vehicle on or across slopes? [Yes = 2, No = 5, NA = 1]

Comments: Shelter exceptional up hills. Mini-ambulance a little more sluggish. Shelter carrier seemed top heavy by some operators. Also maxi-ambulance. Feels a little top heavy.

14. Were there any problems with recovering and towing a vehicle?
[Yes = 2, No = 3, NA = 3]

Comments: When lifting ambulance, sufficient clearance does not exist for chains to clear the rear of the ambulance. Procedure changed to decrease tow bar length to 3/4 of recommended.

15. Were there any problems with vehicle storage locations, sizes, and use?
[Yes = 6, No = 1, NA = 1]

Comments: Compartments in ambulances too small (for blankets & aid bags). Space in front for intercom not sufficient. For cable connects to power, intercom must be installed upside down. Unit need to solidity their load list of equipment to identify all... Add doors to side compartments behind cab to add extra stowage capability. It's difficult to remove litters from the outside litter ramp storage compartment. Side storage compartments need a locking mechanism.

16. Were there any problems with the radio and communication equipment?
[Yes = 6, No = 2, NA = 0]

Comments: Should have had PM verify installation of radios and intercoms (including all accessories). Antenna needs a tie down device and hardware. Antenna mount leaks. Intercoms should have been installed prior to test. Needed headsets. Soldiers need more training on how to use the radios. No stowage provision for comsel device. Intercom system lacks usable headset designed for aidman's use. None for shelter carriers. Due to a lack of a functional intercom system, attendant cannot talk to his command and medical regulating elements. Access to antenna is poor.

17. Were there any problems with tires and run-flat devices?
[Yes = 2, No = 5, NA =1]

Comments: Need procedure to inform operators of tire removal and replacement in operators manual. Need lug wrench on vehicle including jack or lift device. Tire balance or alignment may be causing a front-end shimmy. One failure of a metallic run-flat device, crack developed.

18. Were there any problems with emergency and/or pioneer equipment?
[Yes = 3, No = 5, NA = 0]

Comments: Curtain on shelter carriers flaps against fire extinguisher and bracket. Pioneer tool racks are not universal.

Ambulance

19. Were there any problems loading/unloading ambulatory patients? [Yes = 1, No = 5, NA = 2]

20. Were there any problems loading/unloading litter patients? [Yes = 5, No = 1, NA = 2]

Comments: For litter ramps: cumbersome, slow, patient's head hits during load, not loaded at a proper angle, light-framed troops have difficulty, loading requires more than a 2-man crew. Litter ramps are awkward to use. Litter patient will hit head on rear edge while being loaded into vehicle. Troops need to be trained for a proper loading/unloading procedure. Need increased training for litter ramp use. A training support package is required. Use of ramp is difficult. Upper berth is too high and makes loading difficult.

21. Were there any problems with patient restraints and/or transporting patients? [Yes = 7, No = 1, NA = 0]

Comments: Need safety belts for ambulatory patients. Need stable arm rests or shoulder restraints. Perhaps a shoulder harness. Need seating restraints. Need better litter hold-downs. Need better handholds to control bouncing around. Need acceptable type of ambulatory patient restraining devices. Also litter hold-down devices do not work properly. Transporting patients should be covered in a training support package. A restraint system for ambulatory patients is requested to supplement the hand strap assemblies. Need some patient restraints for ambulatory patients. Suggest seat belts and better litter locking devices.

22. Were there any problems with attendant communicating with the driver and/or patients? [Yes = 4, No = 1, NA = 3]

Comments: Attendant had to move up to the driver's position to adequately communicate. Driver could use a mirror to see into the rear. Must have intercoms to get attendant to communicate with driver.

23. Were there any problems providing patient care/life support? [Yes = 4, No = 2, NA =2]

Comments: Okay for monitoring patients. N/A for life support. Lack of attendant training. Too much noise in back of both ambulances to take vital signs. None if training support package is provided. Difficult to provide any live vital signs while vehicle is on any road surface.

24. Were there any problems using and directing lights (white/blue)? [Yes = 0, No = 5, NA = 3]

25. Were there any problems stowing/accessing medical equipment and essential supplies? [Yes = 3, No = 3, NA = 2]

Comments: Need better stowage for aid bags to allow easy access. Suggest a wall hanging position while the bag is open. Attendants did not inventory their aid bags or have knowledge of proper stowage facilities for them. No place to properly stow aidman bags. No provision to stow land equipment.

26. Were there any problems using medical equipment for patient care? [Yes = 2, No = 3, NA = 3]

Comments: Couldn't use the stethoscope due to noise. Also, where to stow trash.

Shelter

27. Were there any problems loading/unloading electronic equipment? [Yes = 0, No = 3, NA = 5]

28. Were there any problems stowing/accessing electronic equipment? [Yes = 1, No = 3, NA = 4]

Comments: Weight limitation for vehicle kept some equipment from being included. On TR113, left out multi-channel racks. For GRC 142, left out comsel device.

29. Were there any problems stowing/accessing crew/section equipment? [Yes = 5, No = 1, NA = 2]

Comments: Need an adjustable folding ladder with handrail. Include a platform device to cover tailgate gap tripping hazard. Combination of land and personal gear made the shelter carrier overweight. Need specific stowage area provided for shelter gear stowage.

30. Were there any problems mounting/dismounting the generator? [Yes = 0, No = 5, NA = 3]

31. Were there any problems towing the generator? [Yes = 8, No = 0, NA = 0]

Comments: Generator trailer is not as capable as the HMMWV shelter vehicle. Would like to see the generator incorporated on the vehicle. Drivers did not know their trailer could not keep up with the capability of the HMMWV. They could not see the trailer behind them and did not realize the trailers were bouncing all over the road. Trailer for shelter HMMWV is not designed for HMMWV cross-country speeds. Trailer maximum speed is 15 mph. Driver is not aware of the ride delivered to his trailer behind the HMMWV. Generator trailer is receiving structural damage due to its inferior suspension to the HMMWV and also since the drivers cannot see what is happening to the trailer while they are driving on cross-country. Speed of HMMWV creates a problem for towing the generator trailer. Trailer suspension needs improve-

ment to keep up with HMMWV. Generator trailer is not as capable as the HMMWV shelter vehicle. Would like to see the generator incorporated on the vehicle. Trailer cannot handle the cross-country trails as well as the HMMWV.

32. Were there any problems with safe handling of wires/cables?
[Yes = 0, No = 6, NA = 2]

33. Were there any problems with antenna preparation and breakdown?
[Yes = 0, No = 4, NA = 4]

34. Were there any problems arranging and using lights?
[Yes = 0, No = 2, NA = 6]

Maintenance

35. Were there any problems during wheel, tire, or run-flat device maintenance? [Yes = 3, No = 5, NA = 0]

Comments: Not sure if correct type of tape is noted in maintenance manuals for attachment of run-flat device lubricant. Maintainers are not repairing tires, just swapping out new tires. Maintainers need more inducement to follow procedures. Example: lubrication.

36. Were there any problems during brake system maintenance?
[Yes = 8, No = 0, NA = 0]

Comments: Two-fold problem: 1) reinstallation of brake calipers; 2) design of parking brake connection to caliper. Brakes on HMMWV-HVs did not represent production models, adjustment of the calipers could not be achieved per maintainers manual. Rear brakes burned up on several occasions. Difficulty adjusting parking brake cables. Brakes needed many adjustments and sometimes locked up. Tools and procedures were not available for maintainers.

37. Were there any problems during suspension system maintenance?
[Yes = 1, No = 5, NA = 2]

Comments: Ball joint and sleeves required weekly maintenance.

38. Were there any problems during transmission, differential, or final drive maintenance? [Yes = 0, No = 2, NA = 6]

39. Were there any problems during engine maintenance?
[Yes = 1, No = 7, NA = 0]

Comments: One of the vehicles was shipped with broken alternator bolts. A couple of the ambulances have very loud squealing which seems to come from the belts.

40. Were there any problems during fuel system maintenance?
[Yes = 1, No = 5, NA = 2]

Comments: Did not have a container small enough to fit under the drain petlock. Makes fuel system checks for contamination difficult.

41. Were there any problems during lubrication system maintenance? [Yes = 0, No = 4, NA = 4]

42. Were there any problems during cooling/heating system maintenance? [Yes = 5, No = 2, NA = 1]

Comments: Unit does not have refrigeration repair capability. Need of training, org. troubleshooting, and operator familiarity to system operation details. Operators need to understand thermostat device. Took 4 hours to fix a maxi- system heater. Need freon available. Vehicle delivered low on freon. DS maintenance should have air conditioning system repair capability. Recommend that operators are given ability to replace bulbs and issued spares. Need to get maintainers trained to work on air conditioning.

43. Were there any problems during electrical system maintenance? [Yes = 3, No = 4, NA = 1]

Comments: Not enough electrical system maintenance. New alternator was delivered with improper electrical connections. Manuals did not have complete steps for installing the 100 amp kits in the shelter carriers. Instructions were not provided for the DC power cable for the 100 amp kit. The hole for entrance of this cable was not provided. Rear ambulance 24-volt receptacle is inoperative.

44. Were there any problems during lighting system maintenance? [Yes = 4, No = 4, NA = 0]

Comments: Recommend that operators are given ability to replace bulbs and issued spares. Drivers should be allowed to replace burned-out bulbs. Deadlining vehicles for 1 out of 4 inoperative ceiling lamps should be reviewed.

45. Were there any problems during communication system maintenance? [Yes = 3, No = 2, NA = 3]

Comments: Recommend a communication equipment maintainer be assigned to or. maint. (MOS 31V). Did not have an operational system. Must get outside help to fix radios.

46. Were there any problems during emergency equipment maintenance? [Yes = 0, No = 5, NA = 3]

47. Were there any problems during body component maintenance? [Yes = 1, No = 6, NA = 1]

Comments: Tears in revcar developed due to some rivet failures.

48. Were there any problems with tools or test equipment during maintenance activities? [Yes = 2, No = 4, NA = 2]

Comments: Tool kits issued to maintainers do not have all the tools they require for HMMWV-HV

49. Were there any problems with the maintenance manuals during maintenance activities? [Yes = 4, No = 2, NA = 2]

Comments: Maintainers need training to follow manuals properly. Supplements should have been compiled into manuals prior to issuance of vehicle at operational test.

Training

Was the NET for drivers adequate in terms of:

50. Vehicle controls/displays? [Yes = 4, No = 1, NA = 3]

Comments: Did not get presented with all the equipment on the vehicle.

51. Driving practices? [Yes = 3, No = 2, NA = 3]

Comments: None provided. More emphasis on problems created by increased width of vehicle.

52. Communication? [Yes = 0, No = 5, NA =3]

Comments: No formal training for use of radios; training performed within unit. None provided. No training given communications systems not complete or connected, had to provide secondary means of communication (Motorola walkie-talkie).

53. Operating auxiliary equipment? [Yes = 0, No = 4, NA = 4]

Comments: No training on use of ambulance equipment, communications, operating using unique equipment, and special maintenance for HMMWV-HV. None given. More in-depth NBC training.

54. Vehicle recovery/towing practices? [Yes = 0, No = 3, NA = 5]

Comments: No NET for recovery given. None given.

55. Emergency equipment/procedures? [Yes = 1, No = 3, NA = 4]

Comments: Just standard practices. None given.

Was the NET for ambulance attendants adequate in terms of:

56. Ambulance controls/displays? [Yes = 0, No = 4, NA = 4]

Comments: No NET given. Not yet given.

57. Attendant practices? [Yes = 1, No = 2, NA = 5]

Comments: No NET given. Not yet given.

58. Communication? [Yes = 0, No = 5, NA = 3]

Comments: None given. Not yet given.

59. Patient loading/unloading and restraining practices? [Yes = 1, No = 2, NA = 5]

Comments: None was covered by NET.

60. Patient treatment practices? [Yes = 0, No = 3, NA = 5]

Comments: No NET given.

61. Medical equipment stowage/use practices? [Yes = 0, No = 4, NA = 4]

Comments: Still changing the loading/stowage procedures.

62. Emergency equipment/procedures? [Yes = 0, No = 4, NA = 4]

Comments: None given.

Was the NET for shelter crew adequate in terms of:

63. Shelter controls/displays? [Yes = 2, No = 2, NA = 4]

Comments: None given.

64. Crewmember practices? [Yes = 0, No = 2, NA = 6]

65. Communication? [Yes = 1, No = 2, NA = 5]

Comments: None required.

66. Shelter mounting/dismounting and tiedown? [Yes = 0, No = 5, NA = 3]

Comments: No training given. None was given.

67. Shelter equipment stowage/use? [Yes = 0, No = 2, NA =6]

Comments: None given.

68. Generator handling/operating procedures? [Yes = 0, No = 2, NA = 6]

69. Emergency equipment/procedures? [Yes = 0, No = 1, NA = 7]

Comment Taxonomy

Throughout the test, human factors personnel recorded both solicited and unsolicited comments or observations made by test participants. Each comment was coded according to the taxonomy presented in Table 5. The taxonomy allowed the comments to be sorted, organized, and presented to the OTEA test directorate in a variety of useful formats. Each comment was categorized as falling into one or more of five categories: 1) MANPRINT Primary, with 22 sub-categories; 2) MANPRINT Secondary, with the same 22 sub-categories; 3) System Component, with 14 sub-categories; 4) Critical Tasks, with 19 sub-categories; and 5) Test Issue, with 8 sub-catgories. However, for the purposes of the present report, the comments of the participants are presented using only the MANPRINT primary categories. These comments follow the table of comment taxonomy codes.

Table 5

Comment Taxonomy Codes

MANPRINT Primary (1)	MANPRINT Secondary (2)	System Component (3)
A. Training and Training Aids	(Same as Column 1)	A. S-250 Shelter
B. Safety and Health Hazards		B. Maxi-Amb. Shelter
C. Manpower and Personel		C. Mini-Amb. Shelter
D. Crew Station Design		D. Vehicle (S-250
E. Communications		E. Vehicle (Maxi-Amb.)
F. Controls and Displays		F. Vehicle (Mini-Amb.)
G. Anathropometrics and Biomechanics		G. Generator
H. Environment		H. Trailer
I. PMCS		I. ORG
J. Test Equipment and BITE		J. DS
K. Tool Supply		K. GS
L. Parts/Supply		L. DEPOT
M. Maintenance Level		X. Other
N. Maintenance Manuals		Y. Not Applicable
O. Operating Manuals		
P. Maintenance Procedures		
Q. Operating Procedures		
R. Equipment Design		
S. MOPP-NBC		
T. Stowage		
X. Other		
Y. Not Applicable		

CRITICAL TASKS (4)	TEST ISSUE (5)
AMBULANCE CREW to:	A. Mobility
A. Negotiate terrain with patient(s)	B. Recovery
B. Negotiate terrain without patient(s)	C. Stability
C. Load/unload injured soldiers	D. Patient Care
D. Perform lifesaving steps while in motion	E. Commnication
E. Perform lifesaving steps while halted	F. RAM
F. Inventory supplies/resupply	G. Training
SHELTER CREW to:	H. Human Factors and Safety
G. Negotiate route	
H. Deploy antenna	
I. Generator operational check	
J. Power up	
K. Establish radio contact	
L. Tear down equipment	
M. Retur/relocate to next check point	
BOTH AMBULANCE AND SHELTER CREWS to:	
N. Supported recovery	
O. Stow equipment	
P. Operate on run flat tire	
Q. MOPP/NBC operations	
X. Other	
Y. Not applicable	

A. Comments on Training and Training Aids

- Maxi-ambulance attendant did not know how to operate the ambulances air conditioning system for patient complaining of stuffy air.
- NET training covered HMMWV driving only. New NET doctrine should be established for ambulance shelters. S-250 securing kits, comunications training, vehicle loading schedules, operating procedures, and inspection procedures.

B. Comments on Safety and Health Hazards

- Ambulatory patient riding in A03 complained of feeling nauseous while riding cross country.
- Maxi-ambulance patient complains of nausea during cross country travel.
- Patient's back hit the rear edge of the maxi-ambulance lower berth while unloading the litter.
- Taking vital signs is a severe problem (13A) because if someone needs to have their vital signs taken every 2 minutes, you can't do it. If that person has no vital signs then you have lost a patient and you don't even know it.
- Maxi-ambulance aidman suggests limiting ambulance speed while traveling with ambulatory patients due to lack of seating restraints for the patients.
- Maxi-van needs hand straps. Crew loops litter straps to make jury-rig hand straps. Ambulatory patients have no good way to brace themselves during movement of the vehicle. Only way to brace is to put foot against the opposite litter or bench seat bottom.
- Maxi-van has no restraining belts for ambulatory patients. Trail and cross-country rideability is too rough not to have belts.
- A flashing light in the driver's control panel lets him know that the back door is open. I've seen a few drivers taking off with the back door open and because of the noise of the engine the driver could not hear the attendant telling him to stop.
- I feel that along with holding straps, seat belts would should also be placed in to help keep ambulatory patients secure. Padding in the maxi is needed. Patients could bruise their backs while traveling on trails.
- Litter strap for strapdown use gets in the way often when loading litter patients; strap hookups get caught under litter.
- The maxi-amb ambulatory seats could use some cushioning.
- Maxi-van litter bearers can cut their hands on loading ramp sharp edges. The clearance between loading ramp and bottom of litter is too close when they insert their hands to pick-up the litter.
- The Maxi-van upper litter rail needs padding. Attendant's rack will smash into it. The head clearance while working on the patients in the litters is confining.
- Can't perform CPR on bottom litters of Maxi-van at all.
- The material used in the cab and carrier will allow the least ammunition to enter through the vehicle; it's supposed to be bullet proof or so I thought.
- The Maxi-van bench seat has sharp edges at top sides that will cut.

- The mini-ambulance could use a cooling system because when you have a heat injury PT you would have to travel with the back door open because in the summertime most PTS we pick up are heat injuries, i.e., casualties from road marches, training exercises, basic trainng, etc.
- Attendant seat dangerous on sudden starts or stops depending on which way he is facing.
- Step seat in mini-ambulance has severely limited head room. User must crouch.
- Combat helmet (Kevelar) is too heavy to and causes head irritation from extended periods of driving. It causes neck muscle fatigue and shoulder muscle fatigue.
- Mini-van - ventilation. Odd smell emanates from vent system. Smell was stronger in drivers compartment. With the compartment doors closed - it becomes too stuffy and smelly. Individuals who ride in the vehicle become ill. The smell seems to be an engine odor. It's hard to describe, need to find out where vent air comes from. Smell gets worse on HI fan setting.
- Maybe it's the lack of windows that causes people to get nauseated. It'd be easy to have a window with a blackout curtain.
- PT riding in the back of the mini-amb if over 6'4" and riding on the cushions designed for ambulatory PT have the chance of bumping their head against the roof, when passing over bumps.
- Dust comes in the water drain holes and the back door. Can't keep dressing clean. This dust is very bad for medical work.
- Mini-van - rear door locking system needs to be changed to a dead-bolt type of lock, U-Haul trucks have such a system. Doors appear to be locked and are not secure.
- Need a back-up ventilation system. How about a roof vent. Need cross ventilation.
- Mini-van - Litter packs, attendants seat, and other interior metal has too many sharp edges - used to be rounded or padded.
- Mini-van - more padding for bench seats and crew seats is needed. passengers seat pad is ridiculous.
- Needs better seat belts. Steering wheel is dangerous in case of an accident. Weight shift when driving shelter is unpredictable around curves to first time drivers.
- Maxi front and felt kind of light and jumpy on the way out at about 25 mph. It was better on the way back with five people in the back.
- Areas near oxygen equipment in both mini and maxi ambulance should be posted "NO SMOKING".
- The location of the gas tank makes the vehicle a death trap due to the fact the vehicle is a close in vehicle. The gas tank is so centrally located that in case it would catch on fire every compartment of the vehicle would receive some of the heat or explotion.
- Corner on the bottom of the front window railing is sharp and dangerous knees bump against it.
- Bad dust problem. Have to stuff rags in cracks and openings to try to keep out dusk. (Forward portion of passenger door frame.)
- It's better now that it's cooled off but in hot weather I was always wet with sweat from the waist down.
- A man without sun glasses could't see to drive. Need sun visors.

- 1. Heat where the engine is located in the cab. 2. Seat for aid-man serves no purpose (no security). 3. Bolts on rails are a safety hazard. 4. Litter racks are not useful. 5. Mounting of rearview mirror. 6. Gear shafts get too warm. 7. Need shoulder belts for driver and front passenger. 8. Vehicle needs some type of sun visors. Is difficult to see when driving towards the sun.

C. Comments on Manpower and Personnel

- Since ambulances have radios and require a consec device, units need a communications chief (MOS, 31V) to handle: operations, maintenance, logistics and consec.

D. Comments on Crew Station Design

- With a full load of ambulatory patients there's no room for the attendant. There's not enough knee room for the patients.
- Debrief comment:...For the past 2 weeks the patients have been driving out to the test site in the M10-10 ambulance. There is no comparison regarding comfort. Absolutely no dust enters the vehicle. I've never felt nauseous, and there's padding for patient comfort. Compared to the Gamma Goat the maxis and minis are a vast improvement, but the M10-10 is classes above them. Possibly the correction of the ventilation system would help the most.
- Debrief comment: A possible suggestion for the loading ramp--have the ramp attach on the underside of the upper berth so it will just slide out. The crewman won't have to take the time to assemble and move the ramp around. Just have two ramps, one attached to each upper berth.
- Mini-ambulance driver complains that the cab is always hot. That hot air only comes through the vents, seems like the heater is always on.
- Maxi-ambulance driver would like to see the radio moved from the center console to a position above the windshield in the area next to the upper storage cabinets.
- Aidmen have trouble securing themselves while administering aid to patients. Suggestion for a harness of some type.
- Driver's right leg gets too hot next to engine, no ventilation.
- Maxi-ambulance attendant had difficulty taking vital signs of a patient due to rough ride and noise inside van.
- Maxi-van - attendant's slide seat needs more discrete positions. Three positions are now available. Five would be ideal.
- The hold open latches on the doors to the drivers compartment are inoperative.
- Frame for door window on maxi or mini ambulance has a sharp corner and caused injury to many crew members knees/thigh.
- Mini-van - Top of dash board on driver's side gets extremely hot during operations. NOTE: This may be the source of the smell.
- Aidman's seat needs some lower back support.
- In S-250 signal HMMWV, driver complains of lack of ventilation, and ventilation that exists is always hot.

- Driver and passenger of S-250 signal HMMWV both request shoulder restraints along with seat belts.
- Driver and passenger side door need arm rests for shelter carrier HMMWV.
- Arm rests needed for driver and passenger of S-250 signal HMMWV.
- Driver's seat needs greater range of adjustment.
- Maxi-ambulance driver's leg hits under dash throttle control.
- The driver's compartment in the maxi had much exposed plastic which could be easily damaged by a rifle or helmet.
- Driver of mini ambulance hit a stump with right front tire. Driver claims seat position is too low for optimum visibility of right front quarter of vehicle.
- The seats don't have enough padding.
- Has anybody told you we need sun visors?
- Dust comes in thrugh the heater vent in the drivers compartment.
- Crewman requests a map light for HMMWV cab during night operations.
- HMMWV passenger seat could use some spring, not just solidly mounted to the vehicle.
- Difficult to see obstacles over HMMWV hood. Especially on right side.

H. Comments on Environment

- My problem getting nauseous was the smell of the ambulance. It is fumes, but not from gas. I think it's the paint. It's very strong because not everyone is sick when they first start riding. But after being locked up with the fresh paint, I could not breath.
- Maxi-van: lot of noise from litter racks during traveling. With patients this noise may be less.
- Mini-van - ambulance compartments needs side windows for additional light and to avoid claustrophobia effect. Windows should have sliding black-out covers.
- The mini-amb needs air conditioning in cab and rear interior. The vent opening should be placed above the door and a few more added for adequate fresh air supply.

J. Comments on Tool Supply

- Tool for adjusting side mirrors is needed for use by operators.
- No tool available to adjust and retighten rearview mirror at base, all HMMWV.

O. Comments on Operating Manuals

- The manual for mounting the S2aa50 specifies a bolt tightening order which is incorrect.
- TM902320-280-1002 needs modification. Should revise the explanation of what is and what is not a deadline.

P. Comments on Maintenance Procedures

- Driver of mini ambulance complains of poor elastic latches for side compartments of vehicle. Two on rightside tore off, or come unfastened during cross country travel.
- When checking power steering it's difficult to check it while the engine is hot.
- Fire extinguisher: when used to suppress a brake fire, fluid only squirted out 2 to 4 inches. Extinguisher not sufficiently charged.
- Unit maintenance needs tools and equipment to repair refrigeration equipment on vehicles; need DS training for repair procedures. Org. maintenance should have trouble shooting equipment. Operator should be trained to properly use thermostat.
- Access to power steering pump check dip stick is hard for operators. Some do not get the cap tightened all the way, thus causing a loss of fluid and possible deadline. Extend the neck of pump and dipstick or remount.
- Maintainers must drop gas tank down to gain access to level sending unit need access plate.
- Bolts for exhaust manifold flange to exhaust pipe on passenger side are very difficult to gain access. Providing access through heat shields would help.
- Vent lines for top of transfer case, differential and transmission are very difficult to reinstall, need to be made of softer material or reinstallation procedures be included in manuals.

Q. Comments on Operating Procedures

- Instructions to tighten the shelter mounting kits should be revised to tighten the single angled bolt first, then the two body-to-bracket bolts.
- To torque the right front shelter securing kit bolts, the passenger seat must be removed.
- The grounding rod bracket on the shelter must be removed before attempting to install the shelter.

R. Comments on Equipment Design

- 1. Doors on shelter carriers close to hand and it's easy to jam your fingers. 2. Heater vent blows right in passengers face. 3. The female part of the seat belt gets caught in battery box cover and gets busted.
- Reinforcement plates for 3 of 4 shelter carriers overcapped the tailgate mount. Tailgate mount had to be cut in order to accomodate the reinforcement plates.
- I don't like the idea of using plastic covers for the cab of the vehicle why can't the signal shelters use the armor plate covers for the cabs. But I realize that could be a major weight factor.
- Very difficult to strap lock to secure ramp in storage compartment.
- Maxi-van bench seat back and bottom needs much more padding. There is none. Going cross country on trails is rough on tail-bone.
- Patient with arm injury cannot maintain seating position during offroad travel.

- Seating for ambulatory patient in right rear seat of maxi-ambulance: patient was dislodged from the seat by a large bump and received a four-inch forearm abrasion and upper leg bruise. Injury to forearm was caused by the rail lock at the front edge of the seat.
- Litter slides on mini-ambulance can cause hand cuts. Should be recessed.
- Aidman's hand gets pinched when lifting litter patients from ramps.
- Maxi-van: same comments as above. Crew needs to have access to top of vehicle.
- Aidman cut finger while attempting to adjust step locking knds on mani-ambulance steps.
- SGT xxx reports that passenger seat requires more padding for cross country travel.
- I like the idea of HMMWV ambulance. It has many good points (i.e., maneuverability, cross country ability and the availability to a better mode of treatment. Some changes that should be instituted are: oxygen, bottle stowage straps should be moved to allow aidman to put administering equipment on bottles. The upper berth of the maxi should be able to disconnect so that it can lay flat on bottom berth to provide room for patient care if you only have 1 or 2 litter patients. Need some sort of way to lock ambulance so everything doesn't have to be removed from vehicle everytime you want to park it. I like the availability of a radio, and the intercom system. I also like the NBC and HVAC systems. I would however like to see seatbelts in the patient area.
- Top litter rack strap in mani-ambulance interferes with step latch lever.
- Can't fold over red cross sign with the deep fording kit on.
- Patient complained that seating stability was poor due to inclined back angle for maxi-ambulance.
- As a patient we've ridden in the back of the M1010 ambulance out to CP2 on those roads and in the M1010 the ride was much easier on us. The seats are cushioned and there are cushions on the walls for the back. It is not as noisy and there are windows in the back. Sure, this is not a tactical vehicle, but some of these conveniences in the M1010 should be included in these ambulances. In the M1010 the heater is on the floor and AC is in the middle above the door way. This makes for easier access and then the aidman doesn't have to reach over the litter patient.
- Litter locking straps for maxi or mini ambulance are difficult to manually clamp down tight.
- Hold down strap around patient's chest caught on the trailing edge of the maxi-ambulance's lower berth while unloading the litter.
- Ambulance rear hooks seem to work ajar while vehicle is traveling cross country and shelter is rocking, twisting doors in their frame.
- Litter securing straps come loose and interfere with unloading patients.
- Maxi-van radio antenna keeps slamming into roof on cross country trails. Reports of damage to the antenna mount have been made.
- Mini-van bench seats need seat belts for ambulatory patients. A wounded individual will get tossed around - especially on cross-country driving.
- Mini-van - bench seats do not have enough depth for comfortable posterior seating. Seat back should also be positioned nearer vehicle side walls to create more seating room.
- Mini-van - bench seats need padded arm rails at each end. Exposed metal is sharp and can cause injuries.

- Mini-van - hand straps should be fastened with a swivel and should be a padded roll-type. (Like a dog collar).
- For litter patients once loaded into berth. Need a head pad so patients will not hit metal when hard stopping or on cross country driving.
- Need better door latches for keeping bulkhead door open in mini-ambulance. Driver side bulkhead door kept swinging back and forth.
- Mini-van - handholds and footsteps need to be built into body so crew can get to radio antennas and cammo nets, etc. on top of vehicle. Crew now stands on door window ledges and vehicle hood.
- Mini-van - doors between crew and back compartment have a too flimsy lock catch. Need a more positive locking open position and hardware needs to be stronger.
- Need a pad for sharp edges located on metal structure that acts as an armrest for seated ambulatory patients toward the front of the mini ambulance.
- Mini-van - safety restraining strap on attendant's seat needs to be relocated. Can't see the unlocking driver from outside the vehicle.
- The mini-ambulance is the ideal ambulance; however, it really does need a good ventilation system. Air-conditioning would be practical.
- Dust is getting past door and step gaskets for the mini-ambulance. Vehicle number not known.
- Mini-van: stowage boxes need to be installed to stow gear and weapons picked up from the injured. Stowage boxes can be put on vehicle sides or reat doors.
- Mini-van - storage racks need to be put on top of the vehicle to carry camouflage nets and the ambulance crew's personal gear. No room inside vehicle to carry personal gear.
- Mini-van: litter racks need to be built in with rollers to assist in loading and unloading litter patients. Present rack system is not liked by anyone involved in this test.
- Put velcro on windows in shelters instead of zippers. Distracts driver while trying to operate zippers.
- Replace plastic side windows in shelters. Plastic gets scratched too easy and renders using mirrors and side vision useless.
- Soft top on S-250 shelter HMMWV is very noisy, allows drafts to reach occupants, and flaps around hitting occupants about head and neck.
- I noticed many problems, some of these were: comfort of driver; visors are needed desperately; seats need to fit long and medium size legs; steering wheel needs to be smaller, tends to get in the way of drivers legs; heat from engine escapes into driver compartment. Some good points are: the vehicle can handle rough terrain and tires are 30 mile run flat; also excellent suspension; tires cause a problem because due to the spacing of treads they tend to pick up debris and fling it to the underside of carrier, this could cause major problems with the vehicle.
- Hard to see when sun is shining in. Needs sun visors. 2. Weight limitation need to be changed. Good points. 1. Truck has the power to climb steep hills. 2. Truck can cross water. 3. Better design of truck well built. 4. Easier to work on - things are out in the opern - easier to clean,
- Water leaks into driver compartment from the roof and doors.

- Litter lock-down straps get caught on litter while patient is loaded or unloaded.
- The right side mirror can't be adjusted so that the driver can use it.
- Pioneer tool set would not fit under 302 due to lack of angled latch bracket hardware. Tools have been stored in back of ambulance.
- There's no hold up for the door of the storage compartment behind the driver.
- HMMWV tailpipe points toward the ground and blows up too much dust. Direct the pipe to the side as is done on most other vehicles.
- There should be a cotter pin to hold the bolt at the top of the front shocks. One of those bolts came loose on a maxi.
- Weather stripping under the hood is wearing out. See how it's torn.
- Rear view mirror screws don't have lock washers. The screws are coming out and being lost.
- Rear corners of hood on both sides catch on mirror bracket when hood is lifted. The corners of the hood are breaking.
- Overall the ambulances are good with the exception of those problems identified here. The runflat tires are excellent, all military vehicles should have them.
- Debrief comment: engine fan sucks up too much horsepower and affects performance.

T. Comments on Stowage

- Shelter carrier cannot be loaded to carry camouflage TA-50, water, and other necessary items. Trailer gets the tar beat out of it, i.e., broken shocks, cracked frame, busted seals. Ball joints need to be strengthened to accommodate shelter without breaking.
- Need a stowage provision in the ambulances for a comsec device.
- Blanket set bag stowed in the back of a mini-ambulance (802) blocks vent.
- Could make a storage place under the litter in the mini if the seats were redesigned. Better if more like the maxi but should pad the lower rack.
- Fire extinguisher is carried on floor boards loose behind the drivers feet because there is no designated place to put it.